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Miscellania
Medica & Chemica

Containing

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A

Theo-eulogiac Oration

on the structure

of

the human body.

If all god's works that do this world adorn
There is not one more fair and excellent
Than is man's body both for power & form.

Spencer.

Amongst all the works of creation which point out the agency of an infinitely wise author, none can afford a more striking proof of consummate knowledge & an active designing principle than man; whether we contemplate him as an intelligent being & view the nobler faculties of his soul & the depths of his understanding; or the various affections he is endowed with & the relation he bears to society & God; or whether we consider him as a new machine & compare our views to the structure of his frame. At present we shall confine ourselves entirely to the latter.

With whatever part of this wonderful fabric we begin our views we shall find abundant cause to admire the unbounded skill of the great architect

The mechanism & strength of the bones variously fitted to sustain & give shape to the body, their different sizes form & capacity as suited to their different uses and marks of particular foresight.

How exactly does the shape & texture of each

answer its peculiar end. The cylinder of the thigh bones & legs are best adapted to sustain the incumbent weight of the fleshy machine, the gentle curve of the ribs best suits their easy motion for the act of respiration. Their reciprocity & correspondent make, form a secure lodgment for those important organs the heart & lungs. The spherical shape of the bones of the skull whose tables are of the most compact fibres, & of
every way surround the tender & delicate substance of the brain are its best defence against external injuries.

The small & numerous bones of the ancle & wrist, being no less than seventy eight in number are fitted by their shape & strong connections to perform that multiplicity of motions they are endowed with.

The various articulations evidence equable skill & design; thus the Teeth are fixed immoveable in the jaws like a nail in its bed. Cartilages intervening between the ribs afford them an easy motion. The bones of the spine or back mutually receiving and

being recieved by each other compose, not one alone, but many joints, & thus admit a sufficiently free play, which however is wisely confined to proper limits to prevent a compression of that vital marrow which descends thro' its capacious canals to animate every limb, & swell every muscle for action: so that at the same time it has strength to support the body and flexibility to comply with all its postures

The bones being thus formed connected & joined for various motions; majesty accompanies every step, dignity attends each gesture, & every attitude has its peculiar charms.

The composition & action of the muscles are a bright display of the infinite wisdom and excellency of our great creator (& bountiful benefactor) who has fashioned these moving powers after a variety of patterns to answer the greatest use, elegance and convenience, being made of rectilineal or penniform fibres as they may be designed either for strength or velocity. The rectilineal fibres contract in an uniform manner whilst the penniform fibres acting in

in an oblique manner exert a much greater strength

The mechanic Laws are strictly followed in the animated machine, for the quantity of motion is ever the same altho' the contraction of the muscles varies, as for example in the Rectilineal fibres what is lost in strength is gained in velocity & vice versa in the semiform fibres what is lost in velocity is gained in strength, & every muscle is disposed in the wisest & best manner being never substituted one for another but to answer the different purposes assigned them & to proclaim unerring wisdom in the workmanship.

Should we now trace out other parts of the body we should still be surprized with equal or greater wonders; should we follow the various fluids that circulate thro' the several veins & vessels infinitely lessening, we should adore that power w.ch impells them all thro' those intricate channels & so directs their course that they never miss their way.

what exquisite skill is discovered in the

action of the heart that vital fountain, & in the arterial system which like the wells of nature con-
=tinually move within us, & afford a fluid to the glands,
by whose nice operations the finest excretions are
made to repair those incessant decays this frame
is subject to.

All the arteries arise in two trunks from
the two ventricles of the heart; the one distributes
blood to the lungs, the other to every part of the
body besides. These being wide at their origin &
lessening as they ramify bridle the rapid course
of the blood; whilst the veins which are only the
extremities of the arteries reflected back to return
the blood to the heart, are small in their rise &
enlarge in their course, & the celerity increases from
the branches to the trunk; the velocity of the blood
both in the arteries & veins being always reciprocally
as their capacities.

Beside those already mentioned the heart is
furnished with coronary arteries which ramifying
into

into innumerable minute branches pervade its whole superficies, & the blood destined for the heart itself is returned by corresponding veins. / Such is the foresight of the divine mechanic who formed this bodily fabric & preserves in order all its movem.ts to prevent a compression of these vessels w.ch would otherwise unavoidably ensue, these arteries are in their diastole or state of dilatation at the same time when those of all the other parts of the body are in their systole or state of contraction & the veins of the heart are empty when all the other veins are full.

The veins not suffering so great a pressure from their contained fluid are furnished w.th thinner coats tunics & provided with valves which admit the regular course of blood but prevent its return, whilst the blood circulating in the arteries as in an inverted cone from the base to the apex have a greater obstacle to overcome on which account their coats are strong & elastic to reach on the blood; hence a constant pulsation is kept up, which affords the most im-

portant

= portant intelligence to the curious physician who
from the different pulses judges of the nature &
stage of each disease, knows their prognostic and
diagnostic signs, & what method of treatment is
indicated to obtain their respective cures.

Elegant for beyond description elegant is the
structure of the Lungs whose arteries & veins are so
thickly spread on its tender surface & thro' its substance
as to compose a kind of beautiful net-work of fine
capillary vessels.— The extreme branches of the
wind pipe open into the cavities of the vesicles of
the lungs to convey the air into the blood by w:
great changes are wrought; those particles being
attenuated & divided thereby which might have
formed cohesions in the veins & thus fitted again
to circulate freely thro' the body. who that has
the least taste for the essays of human skill

can scarcely to be transported at these stupendous displays of omnipotence, & to be charmed with the nice operations of sovereign power.

The further we examine the more we are lost in astonishment both at the materials & workmanship of the body. The eye assisted with the best glasses cannot discover the delicate structure of the brain. What less than a miracle of creation are the nerves, those minute tubes derived from the brain, to convey animal spirits to every part of the body; to diffuse the power of sensation & to give intelligence of every impression from without that might injure the oeconomy? What less than the work of divinity is that provision made to preserve so noble an organ as the brain which is the seat of the vital functions, & upon whose uninterrupted action life immediately depends, to preserve it I say from dangerous obstructions by the anastamoses or mutual opening of arteries into each other, so that an arterial

circle is formed in such manner that if a greater part should be entirely obstructed, yet the brain will be all over supplied with the remainder, a mechanism truly wonderful & never sufficiently to be admired.

What a grand & sumptuous apparatus is provided for the digestion of the aliments, & for assimilating it into the nature of our own body, for its support growth & preservation, which had sufficient time to look into would swiftly us with a large field for curious speculation.

Were we to take a full survey of the vessels & the organs administring thereto, we should be led into a new world teeming the express characters of divinity stamped upon it: but the bounds assigned will not permit me to examin them with accuracy. Who without being lost in wonder can reflect upon the tongue that admirable instrument for articulating the voice & modifying it into Speech: this pliant muscle with the greatest volubility fashions itself into every shape, & goes thro' all the variations of music. The softer air, the languishing strains and the

the strong manly accent are equally under the
command of the voice. How nice is the papillary structure
of the Tongue & its papilla by which the sense of
tasteing is acquired — not less is that of the nose,
or less to be admired the beautiful devarications
of the olfactory nerves & the exquisite perception
of the odoriferous effluvia of bodies striking on
them for the sense of smelling.

I cannot pass by the ear without noticing how
curious is both the external & internal make of it;
the outward tortuous cartilage like a noble portico
collects the sound, conveys it thro' a winding laby-
rinth to the inward chamber & to the organs pro-
vided for the sense of hearing; thus the different
modifications of sound which constitute & embelish
harmony differently affect the auditory nerves &
conveys the impression it recives to the common sensory
the brain & affords us an ample source of pleasing
entertainment; thus the vibrations of each musical chord,
the soft touches of the Lyre, the shrill notes of the

tuneful flute & the harmonious pulses of an animal voice, convey melody to the soul, beguile the toils of life, & make us forget all our cares.

Which next shall we most admire the find but strong coats of the eye or its spherical form &c. is the first contrived to contain the humors within & view objects without? or the transparency of its humors, or shall we admire & that god-like mechanism by which the pupil dilates or contracts to suffer more or less rays to enter & by which the crystalline moves forward or backward in order to examin both near & remote objects, where the most minute are distinctly discerned, the larger most exactly, & the different distances are accurately ascertained.

Say ye who love to research into the secrets of nature, & to learn by what laws this system is governed, who admire the footsteps of wisdom in every part of creation, what have you discovered more wonderful or more manifestative of supreme knowledge

thats the formation of the eye & the faculty of
sight which spreads itself to an immeasurable
distance, & brings the remotest parts of the universe
under our notice; by means hereof we view the
azure expanse of the firmament: the glories
of the spangled heavens: & the ocean spread into
an immense liquid plain: we see & admire the
gaudy attire of nature in the vegetable world:
we behold the enamell'd meadows & all the
beauties of the flowery field.

To add to these & render the whole assemblage
compleat; nerves terminate in every part of the
body for the sense of feeling.

Whilst other senses are confined to a particular
compass this is diffused thro' the whole fabric, &
is neither strained too high or too much relaxed
but is most enjoyed in those places assigned for
a nice exquisite sensation as the lips tongue

This leads me by a natural & easy digression
to conclude with some remarks on the
usefulness dignity & importance of the
of Physic
practice, which I think must appear evident
from what has already been said on the
structure of the human frame. — Of the

and other sensitive parts of the body.

However complicated this machine of ours is, yet with such boundless benignity has the great architect framed it that no disease can invade the economy but an automatic motion or mechanical impulse is necessarily excited in order to shake off the same, to assist nature in performing this is the office of a physician; hence the subtility & dignity of Physiology is sufficiently evident.

If aught more is required to prove its usefulness let those declare it who have long pined under the slow decays of a lingering consumption, till in medicine they found the noble restorative, or who have gasped for breath under a painful asthma till relieved by this noble science; let those speak whom unwieldy Dropsies have burdened or whose torturing fits of the Stone have fleeted; whose limbs have been wreathed with

excruciating pains, who have measured the tedious
moments by the throbbing pulse, without any
truce from their agonies till the wholesome draught
has interposed its kindly aid & as it were arrested
death in his career.

Above all others let those who have experienced
the salutary effects of inoculation in the small pox
& the many other useful discoveries in physic
testify its use. To those I appeal who have been
witnesses of the dreadful havoc which that pestilent
disease has often made, whose baneful influence
breaks up all friendly intercourse & commerce with
society, & which with remorseless fury snatches
away the blooming youth & hoary sire, & stamps
deformity on every visage. How often has it laid
towns waste, depopulated cities: & like a destructive
Locust swept away whole nations & even thinned the
number of mankind? Hail varied physic from
whose healthy magazine the remedy is at length pro-
vided. we behold the scene now reversed, the con-
tagion destroyed & the disease subdued, now health

returning chears the vital frame, now the beautiful countenance is veiled from its malignant rage & every feature still beams with majesty & love.

Let this proclaim it's just dignity, & let that respect which in all ages has been paid to those who have cultivated this matchless study speak it's praise. to say aught more on the head of it is unnecessary than that it gives the nicest & most exact examples of every branch in natural philosophy, the fully clever; the balance & wheel, the screw & wedge, have their existence in the body which is altogether formed by the nicest gauge & with the most geometrical exactness, it further tends to enlarge our ideas on the infinite goodness of that supreme being who fashioned all our members after the nicest laws adjusted them to their several purposes; finally it affords the most sublime entertainment to a rational being to scrutinize into the structure of that body which claims omnipotence for its workman

Heads of a Dissertation

On the Jaundice

Delivered at a meeting of the
Junior Medical Society
January 3.d 1767

Medici est, primum, causam
Morbi investigare, deinde eum
curare, tentare

Hughan

Of the Jaundice

After introducing the Subject by observing that the Jaundice clearly proves the truth of that elegant observation of Hippocrates "per quæ "vivimus & vani vimus, per ea etiam "ægrotamus;" it proceeds in the following manner

1st It gives an anatomical Discription of the Liver with its blood vessels, Gall Bladder & Biliary Ducts.

2d A physiological account of the secretion, uses, & properties of the human bile.

3d A Definition of a Jaundice with its Diagnosis, Prognosis, Ratio Symtomatum & methodus medendi.

In the anatomical part it is clearly proved from dissections and various Experiments that there is no such thing as Hepaticystici ductii to carry the bile immediately from the pori biliarii into the Gall Bladder as was formerly supposed

In the physiological part it is also demonstrated from Injections & analogy that the bile is entirely secreted from the blood conveyed into the Liver by the Vena portarum & none of it from the blood of the hepatic artery as is asserted by many, & that the Bile instead of being the most putrescent humour in the body as Boerhaave Vansweiten & others suppose, is, in fact, the least inclined to putrefaction of any. This proved by actual Experiments as well as by its sensible qualities.

Jaundice defined to be a regurgitation of Bile into the mass of blood & mixing with its Serum generally tinges the skin, tunica Adjunctiva of the Eyes & other parts of a yellow Colour.

Diagnostic Signs enumerated from Sydenham, Hoffman & Vansweiten.

There are various opinions of authors concerning the cause of the Jaundice. The ancients attributed it to a vitiated state of the Liver and

Spleen. Aretæus supposed the Stomach Kidneys & Colon contributed to the formation of the disease. Paracelsus & his followers of the chymical sect pretend that it proceeds from a commixture of salts. Van Helmont says it arises from a stercoraceous ferment. Baglivi, Mead & others are of opinion that the Jaundice often arises from viscid inert bile obstructing the excretory glands of the Liver. — Boerhaave & Van Swieten from a pinguidenous or atribiliary matter, or from an inflammation abscess or cirrhus of the Liver. All these opinions are founded upon a supposition that the immediate cause of a Jaundice is an obstruction in the secretion of the bile, whereas reason, Experience & a subsequent dissection of deceased Icterics, clearly prove that a Jaundice can only proceed from a retrogression of Bile perfectly formed, by having passed

through the secretory vessels of the Liver,
into the mass of Blood &c. V: med: &s:

All the medical writers which I
have had an opportunity of consulting,
Morgagni excepted, who admits of
a regurgitation of Bile into the Blood
as the immediate cause of the Jaundice,
assert, that the regurgitation arises
from an obstruction of the cystic duct.
This opinion arose from a supposition
that the bile is carried immediately
from the biliary pores of the Liver,
into the Gall Bladder, by small ducts,
which they call Hepatocystic ducts;
such as Cheselden Heister, Haller,
Hunter Monro & other accurate Anato:
:mists, deny the existance of such ducts;
as
&, Experiments made, by Ligatures
tied round the cystic duct of live
animals, prove, that there is no commu:
:nication between the Liver & Gall Bladder,
but through the cystic duct, an occlusion
of the Cystic duct, the ductus hepaticus

& ductus communis choledochus being
pervious, cannot produce a Jaundice.
For the cystic bile cannot get into
the blood if its duct is obstructed,
& the hepatic bile not having its
passage into the Duodenum occluded will
never regurgitate so as to produce
the disease. The true occasional
cause of a Jaundice therefore is, an
obstruction of the Hepatic duct or
ductus communis Choledochus,
generally the latter. An obstruction
of the cystic duct no way producing
the Jaundice.

This obstruction may proceed
from various causes as 1st Large
tumors or abscesses in the concave part
of the Liver pressing upon & occluding
the ductus communis choledochus.
2d Inflammations or other tumors in
the coats of this duct closing its cavity or
a concretion of its sides 3d Violent Spasms
or distention of the Duodenum by poison
Plagues or other cause.

4th An obstruction of this duct by viscid tough matter. From this cause the Jaundice in Infants commonly proceeds.

5th A great distention of the curve of the colon or uterus in pregnant women pressing upon & occluding the biliary ducts 6th Stony concretions falling down from the Gall bladder into the ductus communis Choledochus and stopping up the same. This last is the most frequent cause of the Jaundice; the removal of which therefore ought to form the principal Indication of cure.

Prognosis from Hippocrates Sydenham & Pringle

Ratio Symptomatum. — nothing particular being mentioned under this head I shall not attempt a recollection of any of them.

Methodus Medendi

The medicines most efficacious in curing this disease, when it proceeds from calculous concretions, are

(1) Emetics. These by the concussion they occasion of the Liver & biliary ducts often remove the obstruction.

(2) Aloetic purges. These by their stimulating & evacuating property greatly contribute to force the obstruction

(3.) Soap. This acts by dissolving these concretions.

(4.th) Deobstruent Gums, Rhubarb, neutral Salts, Calomel, preparations of Antimony, particularly the antimonial Wine, Whey, Honey, Squills, Garlic, Bitters, Aromatics, Animal Gall & other medicines of a similar nature, are all useful in curing this disease when prudently administered

Copy of a Letter

To Dr. Thomas Bond

On the cause of the adhesion

of

Inflamed membranes

To

Doctor Thomas Bond clinical Lecturer
in the Pennsylvania Hospital.

Honored Sir

As you had occasion in a late very
useful Lecture to mention the cause of the morbid
adhesions of inflamed membranes, which you was
pleased to own is owing to an intervening glue
cementing them together and in which particular
I beg leave with all due submission to your superior
knowledge & judgment in rebus mediis to dissent from
you; therefore, I doubt not but you will with
your usual candor, pardon the presumption if
I should attempt to give you my opinion with
regard to the cause of this adhesion of inflamed
membranes in a more full and explicit manner
than I have heretofore done —— This is a subject
not less curious than useful as it presupposes

a knowledge of the anthropoiesis or formation of the
human machine, and naturally included in it
the doctrine of inflammation or that morbid affection
thereof which is evidently the predisposing cause of
such a preternatural conformation & without which
we may confidently affirm no adhesions of membranes
ever happens. we shall therefore first explain
our sentiments with regard to inflammation and
then proceed to account for adhesions consequent
thereon from the principles then laid down.

The Boerhaavian doctrine of inflammation
as arising from a new obstruction of the vessels, is
almost universally followed by all medical writers,
and indeed it is a simple & curious hypothesis,
but, tho' supported by the authority of a man
I truly revere, I doubt upon consideration it will
appear inadequate & insufficient to explain all the
phenomena we daily observe in inflammations;

after what manner, for instance can we, by this doctrine account for the violent inflammation that sometimes happens from the prick of a pin or needle? how can this be looked upon as a cause sufficient to produce an obstruction in the blood vessels of the injured part either by thickening the blood, forcing its red globules into the lateral serous vessels, or diminishing the capacity of the canals thro' which it circulates; some one of wch at least is essentially necessary (according to this doctrine) to produce an inflammation?

Or, after what manner does the vapours of warm spirit of wine received into the eye produce an inflammation? I presume it will not be alledg'd to be owing to its constringing the vessels so as to occasion an obstruction in them: and that this obstruction afterwards produces the inflammation by lessening the number of vessels thro which the blood passes & consequently increasing its force upon the obstructed ones.

Does it not seem rather to depend on the extraordinary

oscillatory motion excited in the vessels of the eye by
the stimulus of the spirit of wine? And this I think
leads us into a knowledge of the true cause of every
inflammation, viz: That it is owing to an increas'd
oscillatory motion in the small vessels, whether
from some obstructing matter distracting their fibres
or acrid matter stimulating them.

An obstruction without an irritation in the
obstructed part never occasions an inflammation; but
the irritation of any sensible part with a sharp
instrument or acrid matter never fails to produce this
effect, altho' there be no succeding obstruction; as in
the case of burns, the steams of spirit of wine applyd
to the eye, a sharp pin or needle stuck into the end
of the finger, or a splinter run under the nail which
last, in particular, has been known to produce very
violent inflammations especially in delicate habits
& such as are very irritable; here also we might
mention the remarkable pain, tumefaction & inflammation
from the sting of a wasp or Bee as a further argument
to support our hypothesis unless perhaps it should be
objected that this sting has the property of coagulating

thickening the juices in the part which however I am far from thinking is the case, if so, why does sweet oil & other emollient applications so speedily remove the bad effects consequent thereon? for my part I must confess I can see no other way than by their allaying the great irritation in the part excited by that excessively sharp ichor: weapon.

Further: from whence proceed the violent inflammation & tumefaction of the whole leg and thigh from a mortification of a toe or foot as sometimes happens? can this be owing merely to obstruction? by no means; it undoubtedly depends on the violent irritation communicated to the whole leg and thigh by sympathy from the excessive pain of the part affecting the nervous system with an extreme degree of sensibility. And does not this seem sufficiently probable from the remarkable effects of emmollient applications to the part, such as a poultice of stale bread & milk which in a few hours has been known greatly to lessen the inflammation? on what other cause can this depend than taking off the irritation?

Many other instances might be adduced to prove that inflammation is not solely owing to obstruction & a consequent increas'd circulation of the fluids; but I think the above are sufficient.

Here an important question arises, viz: In what part is the inflammation seated? whether in the capillary extremities of the arteries, or in the cellular membrane?

Haller is of the latter opinion; he imagins that in every inflammation there is an exudation of the globules of blood through the pores of the arterial coats into the cellular membrane, in the same manner as we see, from the injecting of a colord fluid forcibly into an artery that runs thro' the cellular membrane, part of it is effused into & distends that membrane; hence a regular smooth uniform tumefaction, which according to him could not happen if the blood was confin'd within the vessels. But these arguments are not sufficient to convince me that this is the case; I am rather inclined to think that the blood in the inflamed part

before suppuration is, in an ordinary way, contained in the small acheminties of the arteries in which it is so impacted by the circulation in the part being increas'd by some stimulus, & the pressure à tergo of the fluids that it gradually distends them up as to form a tumor; which from the infinite number & smallness of the distended vessels, the cellular membrane that is placed between, & the skin or membrane that is stretched over them; are undoubtedly the causes of its smooth uniform appearance: and that this is the case I think is sufficiently evident from the appearance of an inflammation in any pellucid part of the body where the blood vessels can plainly ~~be seen~~ perspicuous as in the tunica adnata of the eye whose vessels are, in a natural state so small as scarce to admit red blood; but on being inflamed may plainly be seen to be greatly distended, sometimes so as to cause a considerable tumefaction of that membrane which being now punctured with a lancet a great quantity of pure florid blood is discharged and a perceptible subsidence & diminution of the capacity of the vessels ensues. This is also agreeable

to the doctrine of Boerhaave whose opinion in this particular I think is preferable to that of some there who, furnished with the discoveries & observations of that great man have endeavoured to improve upon him.

Thus far with regard to the nature & seat of inflammation: it only now remains to see in what manner from these principles we may satisfactorily account for the adhesion of inflamed membranes such, for example as the external membrane of the Lungs with the pleura. that of the Liver with the Diaphragm or peritoneum; of the Heart with the pericardium &c:

Here it must first be observed that in a natural state there is a constant discharge of a serum halitus, or thin aqueous fluid from the vascular extremities of the arteries on the surface of these membranes in order to moisten & lubricate them so that they may move freely & easily upon each other; which fluid is taken up by the patent orifices of the absorbing vessels & conveyed into the circulating

mafs — If now a slight inflammation
closes the membrane the exhaling vessels
will by that means be distended & dilated that instead
of their fluid they will discharge a thicker mucus
humor nearly similar to recent pus, whose finer
particles being taken up by the absorbent vessels,
for only the very finest can now be absorbed since
as the capacity of the exhalent vessels is enlarged by
their pressure upon the adjacent inhalents they will
of consequence be proportionably diminished) a quantity
or inspissated mucus will be left behind, thereby
ing the surface of the membrane: this I take to be
the matter that is by some supposed to be the
cementing medium that joins the two membranes
together; but not to insist on the impossibility
of effecting an adhesion by means of any
the fluids in our body especially in a soft warm
state; ~~this matter is so far other the least glutinous adhesive~~
~~tau nature of this thickened matter is not~~
~~to be in the least sticky or gluey~~, neither in what
manner soever & therefore can never be supposed
to be the cause of this adhesion.

But to proceed, if the inflammation increases so
as to become violent the exhaling arteries become still
more distended & increased in capacity so as to admit
red blood: the membranes themselves are increased
in thickness, & instead of slightly touching each
other they are forced into close contact & nothing is
discharged to moisten their surfaces except blood
which is now permitted to pass out at the dilated
extremities of the exhalent arteries: So that the
opposed surfaces of these membranes in close apposition
may be looked upon as the sides of a recent wound
made with a sharp instrument & brought into contact,
as in fact the extremities of the arteries now so preterna-
turally opened as to suffer violence are so many
little vulnuscula: hence of consequence the vessels on one
side will inosculate or mutually unite by conjunction
with those on the other so that both will become at
length to appearance one uniform membrane.

This exactly agrees with the nature of inflammation
as we before explained; & I doubt not that upon mature
deliberation & a proper attention to what follows unbiased
minds will be fully convinced of the truth of it.

How often do we see the fingers & toes after
burns or excoriations, by letting them remain in contact
with each other, grow fast together: does not this
depend on the same cause as the former viz: an
inflammation brought on by the stimulating agent
by which means the fine vessels are disposed to emit
emit blood, and the fresh wounds being in this
state kept in apposition grow together or in other
words they heal to each other by the first intention.

Dr. Hunter I find is of this opinion in a
paper of his published in the 2d. vol: of the Lond:
medical observations where he says, the surfaces of
inflamed membranes or other parts of the body
when in contact "unite, and their vessels shoot
mutually into each other" —— It often hap-
pens when the adhesion is slight that the vessels
upon separation may be seen to lacerate: and I
have myself seen several instances on opening
subjects whose lungs adhered to the pleura
that the connecting medium was nothing but fine
filaments between which there was no adhesion at all

affording the same connection as we see in a natural
late between the internal periosteum of the cranium
dura mater &c. by all anatomists is allowd to
depend on small vessels running from one to the
other; and without doubt these fine connecting
filaments or threads are nothing else but small
blood vessels.

By this hypothesis we may easily account
for the formation of membranes which is related by
authors to have been found between the lungs &
pleura after violent pleurisies; for in this case
the great inflammation so forcibly dilates the exte-
rities of the vessels, & by their extraordinary increas'd
oscillatory motion urges the blood through them with
such impetus as to cause an extravasation of a great
quantity of it between these membranes, whereby
such a separation takes place & the serous
parts are taken up by the absorbents, while the
coagulable lymph connects with a tough fibrous
substance that in time has the exact appearance
of a membrane becoming organized & supplied

with blood vessels that mutually commun
with the natural membranes on each side
to form an adhesion of the whole.

I tho.t proper to say thus much on inflam
& the cause of membranous adhesions in order that
might have a better Idea of my opinion concer
them, & my reasons for the same. Rude as it
submit it to your candid inspection not in the le
doubting but that you will put a favorable cons
on the imperfections it labors under. I com
therefore with returning you my hearty thanks for
many favours you have been pleas'd to bestow u
which will ever render your name dear to me: th
for the judicious practical observations you daily m
in your course of clinical lectures, many of wh
doubt not will stand as perpetual monuments t
great ornaments of american medical literature.

I am

your most obedient

& very humble Servant

Jon.a Th

Decemb.r 28th
1767

A Physiological Essay on Secretion

Of Secretion

Secretion is that function of the living body by wch various and very different humors are separated from the mass of blood, yet nevertheless so that in any particular part of the body the same humor is constantly generated.

Though there are many things obscure in physiology yet none seems to be more obscure than the doctrine of secretion, since the ultimate fabric of the secretory organs are so minute as to be unaccessable, even when assisted by the senses and the acumen of reason, but as the doctrine of secretion is no less necessary to be understood than difficult to be explained, since we can say but little with certainty we must therefore rest satisfied with the most probable conjecture.

In order the better to understand the nature of secretion, there are three things necessary to be considered viz: 1.st The different classes of humors secreted with their various natures & properties. 2.d The fabric of those organs by which each of these humors are separately secreted from the blood, & 3.d The mechanism of secretion or the manner in which the several secreted humors are separated from the mass of blood.

Pitcairn & after him Michelotti thought it sufficient to make a distinction only between the thick and thin humors, but

this division appears evidently to be too contracted.

Haller's division of them into 4 classes viz: 1st watery, 2d mucous, 3d gelatinous and 4th oily, seems most just and exact, and we shall speak of them in the manner set down, as that appears evidently to be the order that nature has observed in producing them, for in the course of vegetation the water is absorbed by the roots of the plant, it is first converted into mucus in the leaves, stalk, and tender embyo; when the seed is a little more mature it appears gelatinous and at length when the seed is perfectly ripe it becomes an oily farina.

The aqueous or watery humors are nearly if not quite as fluid as common water, neither viscid nor ropy, they are wholly dissipated by heat except a very minute portion of earth that remains behind, not coagulable either by fire alchohol or mineral acids.; Some of the humors of this class being unuseful are discharged out of the body, hence called excrementitious, as the perspirable matter of the skin and lungs, the urine & faeces, the last of wh. seems to be a mixture of perspirable matter & subcutaneous oil; others as necessary to the animal economy are retained, some of which, besides aqueous particles, contain others of a particular kind, such as the saliva, pancreatic Juice, Tears, aqueous humor of the eyes, and perhaps the nervous fluid.

The mucous humors differ from the watery in being viscid, ropy, adhering strongly to solid bodies; they are easily disceable with, & easily diluted by by water, insipid, inodorous, and mostly colorless; they contain more of the solid elements than the watery humors so as when dry to become rough & brittle, they are not coagulable into a gelly either by fire, or mineral acids.

Mucus will mix oil with water as appears in the mucilage of plants which is of the same nature, and most plants particularly the olive when green contains a viscid mucus but when mature oil.

To this class of humors may be referred the matter that lines all the internal passages for air, aliment, or urine, in the nose, palate, fauces, bronchia, lungs, asophagus, stomach, biliary ducts, intestines, vesica urinaria, urethra, of both sex, the uterus, vagina, &c: to wt add the lubricating mucus that humors the scales of fish, the juice of the umbilical cord in a foetus, liquor of the prostates & semen masculinum which last abounds with volatile, odorous particles, & lastly the black humor of the uvea.

The utility of this lubricating humor is very manifest, it serves to defend the tender extremities of the sinewes which are so sensible that the contact of the air, mechanical friction, or any the least acid substances would affect them with a very disagreeable sense unless defended by this mucus, hence suken all mucus of the urethra is abraded by acid injections, the

venereal virus or any other cause a violent ardor urina or
scalding is perceived; so likewise in acute diseases or a Coryza
when the mucus that lines the schnederian membrane of the nose
is wanting, the air passing through it causes a very ungrateful
sensation; violent pains & even a dysentery is sometimes
caused in the intestines by the use of sharp saline purges or
any other cause that abrades the mucus of the intestines.

To the class of gelatinous humors belong all those that
are coagulable by fire, alcohol, & mineral acids, nevertheless by
a gentle heat viz: under 140° of Fahrenheits Thermometer they
become almost as fluid as water, and when they have begun
to putrify they are not coagulable by any means; they are
almost bland to the taste and tenacity of a thick gummy
appearance,

To this class of humors belong, the Serum of the blood,
the Lymph, the white of Eggs, the humor that surrounds
the chick in the Egg, the liquor of the amnios, the vaporous
juices of the ventricles of the brain, pericardium, pleura, peri-
toneum, vaginal tunic of the testicles, joints, & probably of
the womb, with the juice of the stomach, intestines and the
lymph itself.

To the class of oily humors belong all those wch when
perfect & freed from their redundant aqueous particles take
flame on the fire or at least contain a great quantity of
inflamable matter; I say when perfect or mature because
originally they are more of a gelatinous than oily nature.

To this clafs of inflamable humors principally belong the
fat, marrow of the bones, & the various kinds of sebaceous
unguents, with the odorous humor collected in certain follicules
of some animals, as civet, Castor, &: to which add the cerumen
of the ear the bile, the inflamable part of the humor and
the milk so far as it is butyraceous or oily.

To these 4 clafses of simple humors we may add some
other of a compound or mixed nature which we may call
miscellaneous. to which some of those humors already men:
tioned may be referred as being manifestly compounded or
made up of more than one element; thus the semen is made
up of the odorous mucus of the testes & the prostate liquor, the
sweat likewise is made up of the subcutaneous oil mixed
with the perspirable matter. the saliva is also a compound
liquor and lastly the chyle is made up of almost all the
humors in the body

All those humors we have now enumerated are
contained in the bloods if not in a perfect state require
but very little change to render them perfect, some consider:
ing this have imagined that there is no great difficulty in
explaining the nature of secretion, supposing it to depend
only on the different size or diameter of the strainers or secretory
vessels but as we have many examples of the same humor
being secreted from the blood by very different glands when

its proper secretory vessel has been obstructed, we should not therefore too hastily conclude that there is a necessary fabric of any particular structure required in order that the same humor may always be separated by that organ, for it is a very noted maxim in physiology that the diminution of one secretion is often compensated by the increase of another

Among the watery humors Hippocrates observed the perspirable matter to be turned in upon the Intestines, and it's very common for people who suddenly expose themselves to the cold that they have a speedy desire to make water. It is said of Michael le Vayer that he never washed his hands but he was obliged to make water

perspiration being obstructed often causes a Diarrhoea and has been known to remove an obstinate costiveness. vinegar more rare but not unknown to the antients it that method of curing Dropsy by covering all the skin with Tar so that by that means stopping the perspiration it may become Diuretic.

The perspirable matter has been known to pass off by the salivary glands. The urine being suppressed often makes its way through very different parts of the body as the Intestines, Skin, Breasts, salivary glands &c. a Boy who made no water for 17 days had a constant Diarrhea.

A girl that was born without any natural passage for urine or stool discharged urine by the breasts yet nevertheless she lived to the age of puberty. from these & many other examples it appears there is no gland but may secrete humors of different kinds.

Of the fabric of the secretory organs.

We are now to enquire into the fabric of those organs by which every humor is separated from the blood.

1st Of the aqueous humors, in many places of the body these humors are separated by means of small vessels continuous to the arteries but smaller than the smallest sanguineous artery, thus the perspirable matter as well of the skin as of the Lungs finds a speedy and straight exit as is evident from fine colored injections passing out thro' the skin in dropsies, in the same manner is the matter of the crystaline Lens & vitreous humor of the Eye secreted.

This is the most simple kind of secretion or straining &c. is made from the arteries by means of continuous secretory ducts, the other kind is by means of Glands of the fabric of &c. we are now to speak.

Those Glands that transmit water constitute a proper genus &c. Morgagnus calls lax Glands into which the blood vessels enter & should be distinguished from other dense Glands; Galen made another division of the glands into those that secrete a pituitous humor examples of these he gave in the lungs, fauces & mesentery, at length Nuck. de la Boe distinguished between the conglobate or simple lymphatic glands and these compound Glands &c. are made up of simple ones conjoined as it were into a glomus or cluster these he called conglomerate &c. Distinctions are still retained.

These conglomerate Glands are composed of lobuli which are

connected by cellular substance, through the intervals of wch the blood vessels and nerves pass; warm water being injected into these lobuli tho' the arteries relaxes them so that the may easily see that they are made up of smaller lobuli between which smaller vessels likewise pass. this division may be repeated until they grow so small as not to be discerned by the eye, these acini or lobuli are firmer the smaller they are. If these acini are viewed by a microscope they appear to be divided into still smaller acini by means of cellular fibres no end of their division be found. The cellular substance between the smallest acini is short & dense but between the larger acini sensibly more lax and longer & now & then mixed with fat till at length it forms one common covering to the whole gland. if these fibres be cut the acini will fall asunder this appearance seems to have caused some anatomists to suppose that glands have membranous capsula or vagina. some glands are more lax than others, thus the glands of the breasts & the parotides are very firm those called Thyroid & Thymus soft, the magnitude of these lobuli be different in different glands they are smallest in the renal capsulæ largest in the Breasts & ovaries glands.

The firmness of the cellular substance sensibly increasing is the reason why some of these glands are much smaller in proportion in adults, than in infants & young animals as the Thymus gland.

The Arteries that go to the Glands are larger in proportion & denser than those that go to the muscles & other parts & are more in number, the veins on the contrary are fewer, more lax and larger than those of other parts. Their nerves are few and small since these Glands are not very irritable.

Most Glands of the conglomerate kind are furnished with excretory ducts, though there are some that have none or at least they are not yet discovered as the thyroid glands.

The excretory ducts are a kind of cabal resembling a vein the smallest radicule of wh. not conspicuous to the naked eye, arise from the like very minute acini & like the branches of a river in their course unite with each other one at some larger trunk, not all at once, but gradually one after another according to the usual laws in all the other vessels 'till all the branches from every acini of the whole gland are united together forming one common cylindrical canal which passes out of the gland and opens into some larger cavity as the mouth. Intestines &c:

The membrane or tunic of these ducts is composed of the tela cellulosa closely compacted so as to be nearly of the firmness of a vein externally of this is a thinner cellular coat beautifully furnished with small vessels running next the true membrane. The interior membrane of these excretory ducts is a continuation of the internal membrane of that cavity into wh. each of these ducts empty their humor as the palpebra

o o

mouth, [illegible]

[illegible]

different [illegible]

[illegible]

[illegible]

with the [illegible]

Glasses [illegible]

[illegible]

[illegible]

excretory [illegible]

readily [illegible]

[illegible]

remains [illegible]

the fabric [illegible]

[illegible]

of the [illegible]

first was [illegible]

have ulti[illegible]

conglobat[illegible]

the cavities

aliquor

and brou[illegible]

[illegible]

Testes be[illegible]

mouth, Intestines &c:

In these excretory ducts a liquor is contained which is very different from the blood and yet there is no doubt but they received it from the arteries though it is no easy matter to demonstrate by experiment the conjunction of the smallest arteriola with the incipient ducts. for by the help of the most convex glasses a canal of a different kind cannot be observed to be continuous with the most minute arteriola, therefore we must have recourse to injections and diseases in order to find it out.

Injections pass with difficulty from the arteries into the excretory ducts of the conglomerate glands, & if its very thin it readily diffuses itself into the cellular substance of the gland.

Thus far we are led on by experience, but much yet remains which the best physiologists are ignorant of, that is of the fabric of those ultimate acini of wch these glands are composed.

Three were two very lately of wch thought they saw the structure of the smallest acini though very different from each other. the first was Malpighius who about the year 1665 taught that these ultimate acini were follicular like those of the simple or conglobate glands, and that they were small round vesicles into the cavities of which the extremities of very fine arteries discharged a liquor which afterwards passed out of them by excretory ducts and brought many arguments to support his opinion. Terrel compared these glands with the viscera as the Liver, Kidneys Testes &c: & he found new large glands of the conglomerate

kind and in like manner made up of acini which discharged their humor by excretory ducts whose minute radiculi unite together in the same manner into one trunk wch empties itself into some larger cavity; also that these viscera are furnished with a great number of arteries wch are stronger & straighter than those of other parts, and injections succeed pretty readily from these arteries into the excretory ducts, in the Kidneys very expeditiously, in the Liver with more difficulty, this racinous fabric of the viscera is more manifest in some other animals than in the human species. These acini may be even connected into larger lobuli by cellular substance as in the Kidneys of the human foetus, and of many animals of the viviperous kind & in fish, &c:

moreover in the Liver these acini appear roundish and are surrounded by cellular substance which acini may be resolved into smaller acini as in the conglomerate glands.

If these lobuli and acini are examined by the help of a microscope they will appear to be made up of roundish corpuscles cohering together & environed by cellular fibres in the same manner as in the conglomerate glands and that these acini are composed of still smaller acini which coalesce into lobuli.

But it is objected to this opinion of Malpighius that these acini are too large to be the elements of those viscera & therefore must be compound lobules made up of smaller acini

After Malpighius had established the analogy between the Viscera & conglomerate glands it might have been asked what is the interior fabric of these abrii this he has not left unanswered for he says they are very like to those of the most simple glands which in like manner are often joined together by loose cellular substance: Lofcius calls the Glandes of this kind congregate ones, so that according to Malpighius the conglomerate glands are made up of clusters of acini which are the same as the simple follicles. Water likewise by conglomerate glands understood a company of simple follicles.

Since Malpighius, Boerhaave, Morgagni, & Nannius have defended this opinion, and endeavored to confirm it by observing the effects of diseases on these glands; there is no visible but what has been observed at one time or other and that not unfrequently either the whole or some particular part of it to have been manifestly converted into large, round hollow follicles whose cyst was one continued membrane furnished with vessels whose cavity was full of a different humor so that there seems to remain no doubt but that the viscera are composed of acini of this kind which by some obstruction become gradually replete and turgid with matter & distended beyond their proper magnitude till at length they are encreased from an incredible smallness so as to become

very conspicuous to the eye

Now in these follicles there was nothing but the proper humor of the viscus, and there are observations extant of great quantities of urine & bile being collected in the morbid acini of the kidneys & Liver. Heller and Morgagni are of opinion these follicles are formed out of the small cells of the tela cellulosa & bring many instances of their being filled with humors & substances foreign to those naturally belonging to the gland or viscus, such as hard white substances of the cirrhous kind in the Liver, kidneys, &c and even stony, calculous concretions have been seen in cells of this kind.

The favorers of the follicular doctrine say that it is a distention of the acini of the viscera with lymph that forms what are called Hydatides. They likewise imagined they had a still perfecter knowledge of the true fabric of the viscera & conglomerate glands by considering that those morbid tumors are very like to those watery, adipose, & cirrhous tumors that are generated in the true simple, sebaceous & cutaneous Glands established with indubitable cavities as often as their proper juice becomes vitious by stagnation; likewise the vesicula of the female ovaria often swell into vitious hydatides, therefore they concluded that it might be taken for a rule that the like events would proceed from similar causes.

From these considerations the Malpighian opinion became settled and was received by almost all the medical world, and it was

received as an axiom that the separation of all the humors was performed by means of glands and that no secretion could be made without a follicle and therefore all the conglomerate gland and viscera were composed of clusters of follicles or of small cells, neither was Nuck spared for attaching the doctrine of the follicles of glands nor Vieussens for affecting that excretory ducts issued immediately from vessels of the first and second order without the intervention of any cavity.

The other opinion concerning the fabric of the acini of these glands is that of Ruysch viz: that all the viscera and in like manner the conglomerate glands are made up of small vessels connected together by cellular substance without the interposition of follicles between the arteries and excretory ducts. Edmond King in the year 1666 first wrote that the viscera were made up of mere vessels: of the same opinion was Nehemiah Grew a man very expert in the anatomy both of animals & plants: Duverney likewise said that the whole human body was composed of vessels & vesicles:

but Ruysch although no wise eminent for either as to his genius, assiduity in reading, or erudition, yet by his custom of injecting dead bodies & the very frequent opportunities he had of consulting, by dissections continued for near 60 years, together with an artful hand exceeds most men and what added more weight to his authority was that he was averse to hypothesis and rarely taught beyond what he saw.

When he was a young man indeed he admitted of glandular
cini in the viscera as in the Liver, Kidneys, Spleen & other
parts of the human body but afterwards finding the white
membranes every where by a skilful injection furnished with
innumerable vessels, and observing the greatest part of
the viscera to be filled with the coloured injection w.ch by macer-
tion in water he could resolve into small vessels he gradually
changed his opinion & from the year 1696 taught that the
viscera, conglomerate glands & most of the simple glands were
composed of vessels alone & admitted of but few crypta in
the human body w.ch were of a glandular fabric. His
principal arguments were of this kind. It appears from
hydrostatics that any fluid passing thro' a small canal into
a large receptacle is greatly retarded in that receptacle hence
its progressive force being diminished & its natural pressure
increased the receptacle will be distended, this reasoning he
confirmed by experiments for by injecting small vessels with
wax or tallow that opened into any cavity it passed with
great celerity into the receptacle where by distending its fibres
it gave a knot like appearance. But in the viscera having
injected the principal artery the smallest arterioles were
filled with the matter which passed into & filled the excretory
duct so as to form one continued thread without the interpo-
sition of any knot between the artery & excretory duct. Now if

the fatty injection does not swell up into a knot between the smallest artery & excretory duct) it follows that there is no receptacle interposed between the end of the arteriola and the origin of the excretory duct consequently no glandular fabric in that place but that the excretory duct is continuous to the small artery. This continuity of the excretory duct & the small arteries is very easily demonstrated by injections in the kidneys, with more difficulty in the Liver & sometimes indeed tho' more rarely in the conglomerate glands

It has been objected by Boerhaave the great patron of the malpighian doctrine that in the cortex of the Brain & other viscera prepared by Ruysch a great part of them was not filled by the injected matter but by maceration is destroyed & falls to the bottom of the vial, if by this he means by this to shew that as the whole viscus is made up of vessels all of w.ch we have not been able to fill by the last injection he is right, for Albinus, Herein reason itself admonish us of it, but if he intend by it to shew that there are glands or follicles in the viscera w.ch escaped Ruysches hand then indeed we cannot approve of the force of his argument. he said that the compressed follicles were obliterated as it were between the filled arteries, but if there was any such thing between them the Tallow would not be able to pass from the artery into the excretory duct: If there was a follicle between the arteriola & excretory duct

it would intercept the course of the injection into the duct
which I think is sufficient to confute that argument, but
Ruysch adds that he never used any violence in filling these
viscera, for if he used too much force another appearance
of things was seen, which looked like a sort of inflamation
which I suppose proceeded from an expudation of the colored
matter from the arteries into the cellular cavernulæ.

From these beginnings Ruysch went on to demonstrate
that the acini of Malpighius, all the viscera & glands were
made up of vessels, thus by injecting the Testicle with Quick=
silver he found it to be compos'd of vessels wound up into lobes
which were conjoind by interposed cellular substance

By carefull injection & maceration also of the other viscera
he found them to be made up of vessels wound up into knots
which Malpighius called acini, the pulpy extremity of the
small vessels in these acini he said very much resembled
the pulp of an apple which nevertheless no body ever suspected
was anything of a glandular fabric. He unravelled the
acini of the Liver without maceration; these preparations
of Ruysch made Boerhaave though the greatest patron of
the contrary sect confess with his usual ingenuity that he
could see nothing in the acini of the Liver besides vessels.

As to the arguments adduced by Malpighius & his celebrated
advocate Boerhaave concerning the morbid appearance of
these glands & viscera, Ruysch says that horrid follicles

full of various kinds of matter may be formed without an original glandular fabric, thus large round collections of condensed membrane, or cyst containing matter like pus but very large may arise in the small cellular spaces under the skin & where there is no suspicion of glands, in the same cavernula steatomous & watery tumors are very frequently found, often not only in the glands but in the cellular spaces matter being retaind by stagnating is congested, the like tumors have often been found in other parts of the body in wh the adversaries of this opinion have never thought for follicles as in the corneatunic of the eye, optic nerve, tympani membrana, the extremities, Lungs &c:

As to the native Juici of the gland being often found in these receptacles we need only observe that the blood also has very often been seen to exude into the small cellular spaces in like manner in the liver the bile being obstructed by being very penetrable it may exhale into these spaces at last so as to tinge their contained humor of its color as we frequently see it tinges the Intestines & peritoneum

Hydatides are of a roundish figure circumscribed by certain limits having a proper coat containing water, are for the most part generated in the cellular cavernulæ or a effused humor stagnates & have been found in various parts of the body where there is no gland,

How are other arguments for the Pergachian opinion as that humors can be separated from the blood without the intervention of follicles between the small arteries and excretory canals, we are certain a fluid exhales from very small arteries through the internal coat of the stomach intestines, the vaporous pores of the skin, peritoneum pleura & the tunics of the eye through wch injections likewise may be made to pass: it is then sufficiently proved that sanation may be performed without follicles.

It is the nature of almost all the humors of the human body that they should be urged on with some velocity that they may be fitted for the necessary uses of life & experim.ts prove that they are moved swiftly. Therefore they cannot be separated by strainers the nature of wch destroys all velocity, Urine, perspirable matter nor animal Spirits can: not therefore be percolated through follicles

Nay there is no humor that is not thick & mucous can be generated through follicles, for it is the common & inseperable nature of all the humors of the human body that they become vitiated by being detained, Examples we have in the Bile, mucus, Semen, adeps, cerumen, milk &c. for how can every where absorbent vessels in the receptacles drink in the stagnant humor whatever is of a thinner watery nature, Therefore the secretion of fluid humors by

by means of follicles is repugnant to the thing itself and to the wisdom of nature.

For these & other reasons which were confirmed by the artful preparations of Ruysch his wilful hand as well as of many of his advocates his doctrine prevailed viz: That the Viscera destined for secretion & particularly their acini & the conglomerate glands are made up of mere vascula connected together by cellular substance so compacted as to form acini & connected together in such a manner that the whole may form one body, besides according to him from each acini or glomer of vessels there is an excretory Duct or many ductuli w.h appear to proceed from the least arteriola as a smaller branch & impervious to the blood, which fabric is certainly discovered in the kidneys, in the other secretory organs indeed it is admitted from conjecture but with the greatest probability of truth. Secretion therefore differs from the common circulation of the blood in this that in the latter the small cylindric artery is continued into a vein equal or larger than itself which is fitted to receive the blood, but in the separation of the humors the excretory duct is smaller than the red arterial vascul like a branch proceeding from that vascule. Among the first Authors of this new doctrine were Sylvius, Peyer Alpinus, a disciple of Ruysch & others

and

and the very candid Boerhaave in the latter part of his
life inclined to this opinion.

Of the cause why certain particular humor is constantly separated in an organ of a definite fabric.

much the most difficult part of the work still remains to be investigated. what we have hitherto said relating to the nature of the humors & the fabric of the secretory organs is supported by ocular demonstration, But when we undertake to explain why this' its proper organ & that only one particular humor is always separated much difficulty arises. nor can we have a perfect knowledge of it unless we know the nature of the very elements of w^h an animal body is composed w^h we have no reason to expect we ever shall.

The enquiry is, why, while the body continues in a sound state, Saliva is always secreted in the parotid & salivary glands & no other humor & and why bile is always secreted by the liver & urine in the kidneys &c, & why we do not secrete urine generated in the salivary glands, saliva in the kidneys, bile in the breasts &c.

The difficulty of the enquiry is increased by considering that among the different classes of humors no one of them is always separated from the blood by an organ of a determinate fabric. if it was so we should only have to enquire how the structure of any organ is adapted to the nature of the secreted humor it contains. Now the contrary of this often takes place. for the aqueous humors are generated by continued vascular as well as by conglomerate glands, and the oily humors are separated by

almost as the different kinds of strainers in the body. this leads us to suppose there is some unknown condition of the secretory organ by wch in any organ that humor & no other is separated.

In subject so abstruse we must join reason with sound philosophy in endeavoring to investigate the same. and

1st We will advance such things as are supported by facts & the rational inductions that will naturally follow. 2d Then we will add what may be said upon the subject when only supported by conjecture and 3d lastly we will briefly touch upon those opinions which are not supported by probable conjecture but by mere hypothesis.

1st As a preparatory condition we must consider the different nature of the blood carried to any particular organ for secretion.

This relates to those causes which are without the secretory organ — We have already said that all the different classes of humors are to be found in the blood and wch are separated therefrom by different strainers. Now its scarce to be wanted but that in any secretory organ, whatsoever may be the nature of the secreted humor, the separation of that humor is easier understood if the blood sent to that organ contains many particles like to those wch are secreted in it. Ah it is certainly true that any humor may be secreted by any kind of secretory organ whatsoever like that humor is abundant in the blood as for example the bile when it abounds in the blood will pass thro' all the glands

viscera or perspiratory vessels of the body, arine in like manner will pass through the pores of the skin, and quicksilver has in like manner been observed to exhale through these pores when great quantities of it has been recieved into the blood.

Now in a sound state none of these humors are redundant but the blood is temperate; but in the most healthy person not all together the same kind of blood goes to every part of the body & it is a very probable conjecture that the blood sent to the liver contains more of the elements of the bile than the blood sent to any other viscus, for oily particles are absorbed from the Mesentery, Mesocolon & Omentum, serious watery aqueous particles from the intestines &c & conveyd to the Liver. the same may be said of the blood sent to the other viscera & Glands containing more of the particles for the secretion of the particular fluid in that organ. If in the head very subtle & noble fluids is generated for it is not absurd to suppose there are very subtle & volatile particles of this kind sent to the head by the carotids. Seeing all the particles of blood are urged on by two contrary powers viz: that of gravity & the impulse recieved from the heart, by the former of w^ch the blood tends to the inferior extremities & by the latter it is propelled in a strait line towards the brain. there seems no doubt but that those particles of the blood w^ch are heaviest & most dense will descend along the arch of the Aorta into the abdomen while those that are the most light & moveable will ascend (as gravitating downwards) with less force towards the head for the force of gravity & power of the heart may be represented by the two sides of a parallelogram, one side of w^ch will be the force of

x This is like a boat crossing a river whose head
kept in a diagonal or oblique direction: if the force of the
rowers was exactly equal with the force of the tide or
head of the boat directed in the diagonal line of an
the sides of which were every one equal to the breadth o
the river at the place of crossing, then the boat impell
by these two different powers viz. of the rowers & o
the stream would drop to the opposite shore in a str
line from the place where it set off. Of such a natu
is the motion of the blood.

gravitation the other the motion receeds from the heart, but the diagonal line will express the middle way by wch the blood will pass or volocited by these two powers, &c. that the less the gravity the more will the force of the heart exceed it, & the greater the weight the more powerful will it gravitate in the arch of the aorta toward the inferior extremities by the vanquished force of the heart, for as in the air so in the blood the denser particles always occupy the upper part, hence by the common strength of the, lighter particles will pass the readiest towards the head & this heavier in the inferior branches of the aorta, from thence we may understand why Camphor, various spirits & other volatile vapors affect the head with sleepe, ebriety, sooner than any of the rest of the body. further also they be reflex the cause of the very volatile poison every powerful veriolous miasma showing its effects first in the face & upper parts. I know not whether the sudden effects of opium & other strong poisons in small doses is not owing to its action on the brain from the same cause, Nevertheless we ought not to carry this mahanical reasoning too far for from the same carried mucus, sebum, Tallow, nutritious juice of the bones & other viscid & inert juices are generated.

2°. Another consideration may also hither be referred. viz: That particles of a particular property are brought to the mouths of the excretory vessels, The straitest course from the heart is the right carotid then the left up to the head. while

the subclavian arteries & aorta inferior with a line drawn
from the mouth of the aorta intersect them at a right
angle or at least very little acute, Now it is agreeable to
mathematical demonstrations & experience that among parti-
cles of different weight propelled with a common force, those
that are the leaste & roundest will pass on in a strait line
with the first direction as having the greatest momentum
being most fitted to overcome any resistance, while the
lighter particles having less momentum pass to the sides of
the tube &c: & easily pass from the course of their projection.
Cartesius's bomb is well known, tho' we project balls
of Lead, Iron, Cork & wood. the lead held the straitest
course & those that were lighter were thrown to the sides. If
that experiment was transfated to the human blood we should
see the most dense & heavy globules projected from the heart
would occupy the axis of the aorta, while those that are
lighter and less dense would verge to the sides of the same
Hence the following corollary will follow viz: That the
most ponderous & ~~lightest~~ smoothest corpuscles projected from the heart
will go on in the straitest course through both the carotids
especially the right to the head; as it well known that
Quicksilver is made up of the smoothest roundest & heaviest
globules & always affects the head & salivary Glands the
readiest. Neither is this speculation contrary to the former
for here not from the less ponderous but the straitness of the way

it comes to the Brain. by keping the axis of the canal & observing
its first direction from the heart
another corollary of quater extent & likewise from these
follows viz: that in the arteries every where & in the secre-
tory arteries the red globules being manifestly the most ponderous
hold the axis of the canal & therefore are urged on into the
contiguous veins while the lighter & more sluggish particles
as the adepts mucus, pass to the sides of the artery. But as
the sides of the artery there are excretory ostiola so that these
particles offer themselves to them & promote the separation.

When blood runs out in a torrent from a large opening of a
cut vessel the red globules will occupy the center of the stream
while the lighter & pales will hold the circumference as like
manner anatomical injections of tallow tinged with Cinabar
the most ponderous Cinabar is found to occupy the center while
the white & almost colorless Tallow occupies the circumference

It is likewise evident that different blood is carried to
different organs of secretion from whatever cause it may
proved. In the tunica choroidea of the eye the arterial blood is of
a brown chesnut color between the membranes of the uvea & the
ciliary ring it is colorless: and from these arteries & their branches
it is probable the aqueous humor exhales. Boerhave not tho'
tho' he afterward began to doubt it that the spermatic artery
sent all its blood with its correspondent vein only conveyed a
colorless liquor thinner than the blood to the Testes. The like
artificial is supposed to take place in the cortex of the Brain. for in it
if any such there be
the subtile nervous fluid is separated not from sanguiferous vessels

but from cineritious arteriola or vascula conveying thinner humors than blood. Either as well as in all other parts of the body pertains the theorem of the celebrated Boerhaave & Viessens who taught that the moveable humors are not separated from sanguiferous or arteries of the first kind, but from another order of smaller arteries, as the serous or those of the second kind, or still smaller as the of the lymphatic &c. convey neither blood nor serum, by &c. means neither blood nor serum will offer themselves to the mouths of the excretory vessels, so that the simpler & purer will be the secreted humor the less mixed the liquid is from w.h it is separated.

It is easier understood how from a few orders of particles those are selected w.h ought to be separated, than from a mass in which divers elements are confused: for the most simple frame of two orders of vessels will separate a humor from a many consisting of these two orders of particles one being separated the other &c. will be pure.

3.d The different degrees of velocity of the arterial blood. although in the conditions of the secretory organ itself much is to be taken concerning the quicker or slower motion of the fluid, nevertheless something w.h does not pertain to the fabric of the secretory organ is necessary first to be explained. The fountain of common velocity is in the heart w.h in the heart itself may be various, & hence as is evident from experience all the secretions will be changed. The velocity of the blood conveyed to any strainer may likewise be different in the action of the artery. Therefore the velocity of the blood may be increased thro' the whole body but more powerfully in the heart by muscular motion & exercise, also by straining &

increased respiration as in parturition, by the use of inflamable spirits, stimulating medicines, aromatics, intense study, febrile irritation or any other cause that increases the number of pulses in a given time).

The velocity of the blood may be greater or less as it comes with w.h to any organ;

the nearer the heart the greater the velocity because the impelling force is then not much diminished, hence the prodigious flow of blood from a small artery near the heart. hence in wounds more blood will flow out of an artery of the same diameter in a given time the nearer it is to the heart. hence we may understand the coldness of the feet w.h very rarely sweat unless in some particular persons. hence likewise the slower eruption & decrease of exanthemata on the extremities.

The blood will flow swifter to those parts of the body whose arteries are strait & opposed more directly to the heart as to the head for the retardation of the blood in the arteries themselves arises from the flexion & angles w.h the branches make with the trunk

Again the velocity will be increased from other causes.

The near the trunk of the aorta the artery of the ovarian organ ovaries the left will be the retardation w.h is made by the flexion division of the trunk & the increase of the diameters of all the branches beyond that of the trunk.

Likewise the velocity of the blood will be better preserved in those arteries w.h proceed from their trunks at small angles. Also the velocity of the blood will be greater in the large than the small arteries because the branches taken all together are larger than the trunk & the friction in them greater from an increase of surface.

In a cylindric artery such as the carotid, celerity is better preserved than in an anomous artery. Lastly there is less velocity lost in the more firm arteries w^ch are less distended & inflected by the impulse of the blood consequently less friction; hence the secretory arteries organs are more dense & strong: hence among other causes one kind of humor in a Fœtus and another in an adult is drawn thro' the same organ, & different kinds of humors are generated by athletics & tender people of the same age

The effects of an increased velocity is very plain: And first the quantity of secreted humors will every where be increased when celerity of the blood is great for a greater number of waves & quantity of blood will be applyed to a secretory organ in a given time, hence animals w^ch lie dormant through the winter have small secretions hence immense perspiration from great exercise of body.

By an increased velocity particles larger than usual will be impelled into the mouths of the secretory vessels; for since all the vessels of a living body are capable of dilatation & are flexible they will be dilated by the increased velocity & momentum of the fluids so as to admit greater particles than they otherwise would by w^ch means larger particles will enter the mouths of the secretory vessels than otherwise could by a less velocity & momentum. Thus water may be impelled with an syringe by a small force through the minima vascula but a greater force is required to impell Tallow into the same. Thus by exercise of body or a Fever instead of a thin perspirable matter a thick viscid sweat, & instead of straw colored aqueous urine, that w^ch is red ponderous & fœtid & replete w^th earthy

particles passes through this same strainer. Lastly the blood itself by having its velocity violently increased penetrates all the vascula of the body.

Hence a too great velocity in many respects renders the secretions impure, urges the humors into the small excretory orifices replete with heterogeneous particles. For altho' these small vascula ought to exclude all the larger particles yet when dilated they transmit the larger with the smaller.

Again the velocity being increased the secretions will be more fluid not having time to grow viscid in their excretory organs. It has been shewn that the progressive motion of the blood keeps different elements, various in weight, figure &c: such as fat, water, mucus, gelatina, earth & iron mixt together, thence when the progressive motion is great it impedes the attraction of similar particles & keeps them separated from mutual contact & renders them less able to attract each other, so that it does not permit the viscid oily particles to unite into homogeneous masses as is necessary in secretion. Therefore by aquat motion of the blood the increase of fat is impeded & of mucus, hence likewise phlegmatic people abound with mucus.

4th Of the slowness of the blood's motion as it arises at the secretory organs.

The slowness of the blood motion may proceed from various causes; when the artery arises in a part remote from the heart & is long & slender it occasions a slowness in the blood sent to the secretory organ, an example of wch we have in the spermatic artery. also a remous artery in wch the

divisions of the branches taken all together are much larger than the trunk, increase the slowness of the blood, motion as also an incurved artery & one that arises at right or an obtuse angle and a soft lax artery wch is much dilated & extended by the impulsive force of the heart; from all these causes the progressive motion of the blood is diminished and its lateral pressure in the same proportion increased.

The mechanical effects of retardation, may be understood almost from the contrary effects of velocity

In the first place secretion will be exalting for less blood will in a given time be applyed to the mouths of the secretory vessels; a slow motion will exclude the grosser particles & render the secreted humors pure. In a fever the urine is thick & heavy, but the blood being restored to its usual slowness a citron colored & watery urine will be again secreted

pure humors we call homogeneous, & these are promoted in many respects by a slow secretion; It is well known that homogeneous fluids attract each other & repell particles of an opposite nature; a mixture of water, fat and mucus separate by rest alone, the viscid particles, the oily & the watery each unite together by themselves, not only viscid oil collects itself into globules but the most fluid quick silver, & even water.

therefore the celerity of the blood being diminished, the cause will be lessened w^ch hinders the aggregation of similar particles; hence if the blood of an artery tending to secretory organ flows slowly the mucous & oily particles will be collected as it were of the blood itself & separate themselves from particles of a different nature so as to bring about that preparation before mentioned viz: of the blood brought to its destined strainer being of such a nature as to abound with those particles w^ch are to be separated from it by that secretory organ

Some great men have imagined this slowness necessary to secretion & even denyed that any humor could be secreted without a slow motion of the blood: for the same reason D^r. Freind has wrote that an acute angle of the vessel is contrary to secretion, but that a right angle favors it.

Again a slow motion increases the lateral pressure & therefore applies the particles destined to secretion to the sides of the vessels where the secretory orifices open, on the other hand celerity urges the blood through the axis of the vessel so that by hurrying through its canal it presses less against the sides of the same: this may be the reason why fat is not much accumulated in men much used to exercise

x to the sides of the vessels by the internal muc
that lines them. Seeing then that they are carried
sides of the vessels spontaneously & are also urged
from the lateral pressure. it is easily understoo
how quickly & abundantly the viscid humors
collected in aquiet & sedentary life.

The effects of a slow motion of the blood is an increased
secretion of the more viscid humors, for at the same time
that the progressive motion is lessened these particles
more readily attract each other so as to form in their
vessels a viscid inert fluid, for they are governed entirely by
attraction when the contrary progressive motion is abstract
thus Nesbitt found in the small vessels of the Bones glu-
tinous particles & others have found such as were glutinous and
fit to repair a Callus which no one ever saw in a large Artery-
By this same slow motion viscid particles being less moveable & sluggish in account
of their viscidity will be pushed from the axis of the artery toward
the sides of the same by others more potent. & are also attracted
On account of these and similar considerations most
physiologists have had respect to the difference of velocity
when they have attempted to explain the manner in which the
different humors are secreted as Cockbourn in his Animal
Oeconomy: Cheyne in his Philosophical principles of Religion &c.
the consideration of the different velocity has joined that of the
different diameters of the secretory vessels: Kiell to the
Different velocity of the blood & different diameters of the
secretory vessels adds the attractive force of the secerning
particles combining in the secretory organ.

We come next to consider the causes of different secretions which are placed in the secretory organs themselves.

Many are the devices which nature makes use of to bring about a separation of the different humors, which we shall hint at partly from conjecture & partly confirm by the Testimony of the senses; here we will consider 1st. The diff.t disposition of the arterioles of the secretory organ, 2d. The diff.t diameters of the secretory orifices 3d. The different degrees of density of the secretory ducts, 4th. The different degrees of irritability of the secretory organ, 5th. The length or brevity of the secretory ducts, 6th. The straitness or crookedness of the same and 7th. The changes that various humors undergo in the Receptacles or follicles by rest, renal absorption, and imbration or the commixture of various humors together.

1st. Let us consider then how much we ought to attribute to the different arterial terminations; we ought to be more solicitous on this account because the most celebrated men have attributed very much to this diversity of the arteries or their net work, & Ruysch himself though little inclined to Hypothesis thought that from this cause alone the variety of secretions might be explained; & that these contribute to the various affections of the secreted fluid we are persuaded from mathematical Experiments viz: That the straiter the

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canal the greater will be the velocity, and also the smaller the angle any branch makes with its Trunk the greater the velocity, together with the diversity of magnitude and other affections of the arteries all of which as we before observed have considerable effect on the secreted humors: moreover in different parts of the body we find the arteries differently disposed & terminated, and as Nature does nothing in vain it is not unreasonable to suppose that they conduce to bring about a difference in the secreted humors,

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2°. Of the different diameters of the secretory vessels.

This is every simple artifice of nature by which red blood is prevented from entering the secretory vessels and in some the gelatina itself. Thus in a secretory vessel w.ch arises from a red artery whose mouth or orifice opening into the artery is less than the diameter of a red globule, it will follow that the blood will be excluded from entering the same but all the other molecula whose diameters are less than that of the secretory orifice will be admitted; hence it is easy to understand that if there are many kinds of circulating particles in the blood, how nature might by a small artifice bring about a separation of them. viz: by strainers adapted to the different magnitudes of the several kinds of particles: Let us then suppose in the blood in the Heart various molecules or particles of different sizes, thus let the red globules be of the largest size, the fat the second, the elements of the bile the third, the particles of yellow Lymph the fourth, those of Saliva the fifth, and the perspirable matter the sixth: Then suppose there are secretory pores whose diameters are equal to the diameters of the particles of the second order & others equal to the diameters of the particles of the 3°, 4th, 5th, & 6th orders, it would follow that the red globules alone would be excluded the pores corresponding to the 2°. order of particles, while the last

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fat, bile, saliva, serum & perspirable matter would pass through, neither blood nor fat would pass thro' those of the third order while bile, serum, saliva, & perspirable matter will be admitted & so of the rest, till none but perspirable matter can pass thro' pores of the last order. That this takes plaw in the human body is evident from experiments, its well known that wax tallow by injection penetrate more but the large vessels or with great difficulty enter the smaller by reason of their grosness & tenacity whereas the fine oil of Turpentine penetrates the minima vasa of the Eye & other parts.

But the sagacity of some great men has gone farther: for they have discovered how by the different disposition of the secretory vessels alone, here humors without the intermix=ture of particles of a different kind may be separated from the blood. Thus if a thick humor is wanted to be secreted as for Example the Bile, the artery destined to secrete that humor by sending off branches in its course whose diameters are less than the molecules of bile, all the particles in that artery less than those of bile will pass off by those pulmonary vessels while nothing will remain in the pulmonary artery with the blood but the particles of bile & perhaps a few other subtle particles; the same may be said of the other secretions.

Thus much of the humors.

If we examin the mouths of the vessels we shall find the venous oscula are the largest so as to admit the red globules of blood, next the lateral oily pores which are so large as often to admit the blood itself: Therefore almost all kinds of Injections will pass into the adipose cells as warm Fat, or Tallow tinctured with thick minium, dissolved Fish Gluten, Water, Quicksilver, or Air. But the mucous vessels & Pancreatic Glands the wax will enter but the particles of animal will not be able to enter with it; On the contrary the narrow exhaleing vascula of the Skin as appears from Leuwhoec's experiments will scarce admit any Wax or Tallow while water easily passes out through them. In the very tender vessels of the vitreous Humor crystaline Lens of the Eye, of the cortex of the Brain &c: none but the very thinest fluid will enter unless with great labor & difficulty.

3d. Of the different degrees of density of the secretory orifices.

Although anatomy affords us but little light in this particular, yet it does some. the rest we must supply by Theory. Supposing the same velocity in the blood & that the same kind of particles offer themselves to the excretory orifice nature nevertheless would separate a different kind of humor, according to the different degrees of density of the secretory canal. the denser the same the greater will be the resistance to the impulsed particles and the less will it be dilated by the increased momentum of the fluids whereas on the contrary the lax secretory orifice less resists the impulsive humor & easyer admits longer & more sluggish particles; Therefore dense secretory vessels will make the purest secretions, but less copious, their sweatory, but the lax secretory vessels will afford impure secretions by admitting humors of diff.t kinds

If we consult anatomy & the various changes of the secretions this probable hypothesis will not be weaked: It is certain that the relaxed organs which before used to admit the denser humors will now transmit thicker. The dense & acerb uterus of a tender virgin relaxed by fomentations and vapor will distile blood instead of mucus. Hence one will be more lax in one who is the mother of many Children & will

secrete avery copious white milky humor. The ony edges of aureum will discharge a thin lymph but if they be relaxed with tepid fomentations emollient applications they will afford a thick pus

4:ths of the different degrees of irritability of the excretory ducts

Although most of the glands are not furnished with many nerves nor afford any conspicuous motion on being mechanically irritated with a sharp needle: yet an irritable nature is not wanting in the glands as it almost every where causes & precipitates excretion even secretion itself as is evident from the quantity of humor secreted & the thinness thereof for want of sufficient stay.

Irritation appears in some measure to expedite excretion even when it does not touch the excretory organ, Thus in child-bed women the milk for the most part is concocted in the lactiferous tubes, but it will not flow out spontaneously unless it abounds beyond measure, but if stimulus be applied to the nipple, either by the pressure of the child's lips, or by the fingers lightly shaking of it, the pallid papilla, will become red, hot & turgid & the milk will flow out. so the semen of a chaste man which has been a long while detained, if friction be applied to the very sensible inferior part of the glans penis it will be ejected though not without violence.

Not only excretion but secretion itself will be increased and accelerated. by this kind of stimulus. Thus by suction alone milk has been brought into the breasts of the most innocent virgin. & Boerhaave mentions a man who by the repeated stimulus of suction alone afforded a sufficient quantity of milk to nourish a male child. likewise by the wonderful mechanical irritation of the glans the secretion of the semen may be so vehemently accelerated as to produce a stoke of the whole body thus nocturnal pollutions & tumors of the testes happen in a gonnorhoea from an increased secretion of semen by the stimulus of that sharp ichor at the end of the urethra. It has lately been conjectured that the liquors flow to irritated glands in the same manner as blood flows to pained and inflamed parts.

In other secretory organs the efficacy of irritation applys is still more evident when made by any sharp body, so as to immitate the phenomena of increased velocity of the secretory organ viz. increases thin & watery secretions instead of their more thick, sluggish & mucous, thus acrid fumitatories cause a very copious discharge of thin watery mucus from the Nose, the masticatin of almost any acrid substance as Tobacco Pyrethrum, will not only greatly increase the excretion of the Saliva but also its secretion.

Almost in the same manner the acrid particles of Emetick

by their stimulus so increase the secretion of tears in the eyes
that the lacrymal ducts not being large enough to convey them
away sufficiently fast the flow over down the cheeks.

Purges likewise so irritate the muciferous glands of the
intestines & the extremities of the small exhaling arteries opening
through their villous coat as often to cause an immense
discharge of water per Anum when not a drop without
that violence would have exited in the Rectum.

Moreover the internal coat of the bladder & continuous
urethra is lined with a very bland mucus not a drop of wch.
ever distills from the glands of a sound man, but if any acrid
liquor whatsoever be injected into the penis of the most healthy
person accession effluxes of a reddish. thin, hot humor will
follow not without pain.

Again a small portion of fat with a thin perspirable
humor transpires through the cutis, but if any acrid stimu-
lating substance be applyed to it for a few hours as Ranun-
culus, Cantharides, or fixed salts the secretion through
the vascula of the cutis will be so incredibly increased that
the pores of the Epidermis not being sufficiently patulent
to discharge the same it will be elevated in hemispheric
bubbles or blisters.

Thus are other examples of irritation which ought to

to be considered, in which no change is made in the secretory
organ nor any stimulus applyed, nevertheless from the
mere influence of the irritating cause excretion & secretion
are increased, the most simple Example of this is of the
increase of Saliva in a sound hungry person by the smell
or barely the name of grateful food. and of the Tears
from sudden joy or grief, the cutting of an onion &c:

likewise venereal Ideas in sleep frequently causes
that otherwise difficult excretion of Semen: moreover as
timid mortals & beasts subject to torment & terror suddenly
checks the perspirable humor & precipitates it upon the
Intestines so as to produce loose stools. Anger accelerates
the flow of bile into the Intestines & often causes a gush
of blood from the nose.

Lastly Luther also pertains that wonderful change of
urine which happens in hypochondriacs on hearing any
ungrateful news.

5.th Of the straitness & winding of the excretory duct &c

It is not to be doubted but that an excretory duct that is strait arising from an artery without any angle or flexion of free from valves & rugæ will make a quicker & more plentiful excretion than all that is the contrary being the obstacles that diminish its velocity & unmasked.

But the shortest excretory duct causes an easy copious excretion of thick humors, for though a short canal, if it be a little narrower it will much easier admit large particles than if the same were long.

Hence it easy to understand how through the strait uriniferous ducts a very copious fluid excretion is made.

The fat is separated by vessels so very short that they scarce can be called any thing but pores, hence a quick excretion of this thick humor & an easy admission of blood through them

The vaulted seminal will flow more swiftly if the seperating vascul is large with an open orifice causing no resistance as in the pancreatic duct.

As contrary causes produce contrary effects, Therefore if the excretory duct does not go on in a strait course with its artery it will difficulty receive the humor and the excretion will be slow.

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If the excretory duct is narrow the friction will be increased & the velocity of the humor diminished in proportion to the length of the same, hence in very long ducts from the continual friction the motion of the fluid will be very slow.

If the excretory duct is very winding the motion of the humor will likewise be retarded.

If the internal part of a canal is full of plaits & rugæ the superficies which the transluent humor touches will be increased which will increase the friction & consequently cause a retardation.

If the excretory duct expands itself into a larger cavity the motion of the humor in it will be retarded in proportion as the capacity of the dilated part exceeds that of the narrow part. If the excretory duct becomes considerably smaller tow.ds its end the fluent humor will be retarded in like manner in the duct itself. Examples of which we have in the mouth of the seminal vascul opening into the urethra, in the mouths of the salivary ducts and in the terminations of the pituitary sinuses opening into the nose.

Anatomy confirms most of these; In herbivorous animals the intestines are very long & faces dry, in carnivorous ones, short & faces fluid & hardly changed. The seminal duct is the longest of all the excretory ducts, & the humor the thickest.

6th Of Receptacles and Follicles.

Nature very frequently uses this machanism, that she may retain, perfect and inspissate the secreted humor & thus render it more fit to answer the purposes it was designed for by her: and then to discharge it at a proper time & occasion.

There are various kinds of receptacles some large which ought not to be reckoned among the instruments of secretion, & others smaller which more properly pertain to the excretory organs. Amongst the larger class of receptacles are the intestines for the reception of the Lik, juice of the intestines, element and saliva; the Gallbladder for the bile & its mucus; the vesica urinaria for the urine; the vasa deferentia & vesiculæ seminales for the semen of the Testes; the capsula of the pointe; the cavity of the uterus, cavities of the Eye, each for the reception of their proper humor

The smaller receptacles in like manner receive their humor, & retain it until they are evacuated by some particular cause: to this class pertain the simple follicles of various kinds which nature every where makes use of for perfecting the viscid humors together with the sinuses or oblong follicles: hither also may be referred the cellulæ & the dilatation of the excretory ducts.

The crypte or nectaria of plants collect a viscid humor.

The same humor is not rarely more than one deposited in follicles receptacles. Thus the mucus of the Nose is discharged from arteriola into small crypta & from thence it is poured out into the pituitary sinuses. the Bile is first deposited in the Gall: bladder & afterwards poured out into the cavity of the Intestines.

Then are various methods made use of to collect & retain the humors in these follicles. The celerity which the deposited humor recieves from the impelling force of the heart vanishes in the follicle if it is shut: but if they are open there must be some machanism to prevent it else as the humor is collected in the follicle so it will be discharged through the excretory osculum.

For this end some have narrow excretory ducts through which the humor collected in the follicle cannot pass unless assisted by pressure. This is the commonest artifice of nature in the glandular follicles, in the great receptacles of bile, urine, semen, in the pituitary sinuses & in the salivary ducts.

When the narrow excretory ducts terminate as in the seminal, biliary, & lactiferous ducts there is valves wch give a difficult passage to the humor through the excretory duct as in the passage of the bile.

In some places the dense tela cellulosa surrounds and constricts the excretory duct as in the prostrate & seminal ducts; or it

it runs in between the membranes of some tube, opening ob-
liquely into it. so that by the pressure of the humor in the
large cavity it may be compressed as in the biliary and
pancreatic ducts

In other parts the excretory duct passes between mus-
cular fibres by the strength of which the humor is coercivated
unless a contrary cause is applyed these are commonly called
Sphincters, as in the neck of the Bladder & the End of the
Rectum &c:

The principal & common effect of the follicles is to
render the humor they secern more viscid unless its entirely
repugnant to viscidity as in the aqueous humor of the Eye &c
But there is no doubt of it in the bile, semen, mucus &c
Thus the pituita of the nose is generated limpid and watery
in which state it flows from the gland in a copious: but
if it remains there any time it becomes thick and viscid. The
cerumen when first secreted is fluid but by remaining along
time in the ear it becomes hard; The Bile when first secreted
in the liver is as fluid as water but after remaining some
time in the gall bladder it becomes thick very bitter viscid.
The semen likewise thickens by lying in the vesiculæ seminales.

Here appears then no doubt but the humors are
secreted in the follicles to be inspissated. by what means
it

it becomes insipissated is easily understood it. Heat may do something towards it by dissipating the thinner volatile particles of all the humors, thus we ascertain the more volatile particles of Bile are dissipated from its follicle by its exterior membrane & that of the adjacent Intestines & peritoneum being tinged of a yellow color

2d By the attraction of similar particles which have now no progressive motion: Therefor watery humors will attract watery particles, oil, oily, & mucus, mucous ones: when therefore fatty or mucous particles are mixed with water & under about impressed through the blood there now cavities by rest will be deposited in the adipose cells in the form of true fat & in the mucous receptacles in the form of true mucus &c

3d By the resorption of the thinner part of the humor.

The resorption of the thinner particles by small veins which open into the cavity of the follicle does the most towards thickning the humors: As small arteriola open very often into the follicle exhaling a particular humor into it so in like manner many small venula arise from the same cavity absorbing the aqueous volatile part of the deposited humor & conveying it into the blood leaving the remainder in the follicle more inspissid.

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It is not difficult to demonstrate this either in the large
& small receptacles; In the large indeed the principal example
is the Intestines in which from a fluid mass of aliment, or in
a febrile person who takes nothing but fluids, there will nothing
but hard dry faeces be collected in the Rectum.

The volatile part of the semen is absorbed as is evi=
dent from that odor or strong smell observed in most
mature male animals

The same kind of venal absorption evidently takes place
in the cavities of the pleura, pericardium, peritoneum,
ventricles of the brain, of the gall & urine bladder and of
the aqueous humor of the Eye, the like also takes place in
the adipose cells, the vesiculæ of the Lungs and all the other
small receptacles or cavities.

4th The humors are depurated in the follicles.

This maturation is of the greatest moment as it comes the
nearest to interpreting that vast Art by which nature repara=
tes different humors of very different properties among each other
from the same mass of blood: even now we can hardly see
how it can be avoided but that the thin humors will be warmed
with the thick ones. for it appears very difficult to account
why the thin humors do not also pass through the thick ostiola.

Neither is this bare speculation, for it is certain that the
fat when it is first generated is mixed with water like to
gelatina. The Bile when first secreted is sweet and watery
the semen thin when it first descends through its strainer
into its receptacle when they are emended by the venal ab-
sorption of the thinner particles while the thicker ones as being
too large to pass off the same way are Retained: acrid par-
ticles often by their stimulus contract the mouths of the vessels so
as to be excluded entrance, by this means the bile seems to
be excluded entrance into the mouths of the lacteal vessels.

The fat when first deposited in the adipose cells is mixed w.
much water which is resorbed by the lymphatics leaving the
inflamable matter behind; the thin bile has in like manner
its fluid parts resorbed leaving the rest more thick viscid and
more perfect bile. The same happens in the humor of the
joints & all the other humors of the body which are rendered
more perfect by the absorption of thin vaporous watery
parts.

5 Divers humors are contained in these follicles.

But as it pertains to the perfection of some humors in order to
under them pure that they be compound of particles of the same
kind on the contrary it belongs to the nature of other humors
that they be made up of diff.t particles coalescing. Now this

commixion of different elements could by no means more commodiously be brought about than in a receptacle in which diverse excretory pores open that convey thither particles of diff.ᵗ kinds, for these are retained in the follicle digested by the heat of the round animal & more powerfully mixed together the longer they are retained.

Divers humors may come together in the same follicle in different manners. The simplest artifice taken from theory is that of arteries of different magnitudes opening into any follicle, or an arterial humor exhaling into it & more sluggish juice from the adjacent glandular crypta, some of which may strain a thicker & other a thinner liquor; we have an example of this in the intestines for in this large receptacle which receives from the glandular follicles a thinner though sufficiently thick one from the conspicuous mouths of the villi & every thing from the small terminations of the arterioles imperceptible even by the help of a microscope according to Nannius.

A humor of a different nature may be contained in a receptacle in another manner thus a thinner humor may exhale into it from the arteries or glands to temperate a thicker one thus it is probable the Haversian albumen in the cavities of the joints has a thin watery vapor exhales from the arteries added to it, nor is it to be doubted but that in the gall bladder

a litterish fatty lymph from the liver is mixed with the mucus
secreted in the follicles of this receptacle & watery latex which
exhales from the arteriola. in like manner a thin humor of this
kind appears to be deposited in the vesicula seminales by arteries
perhaps as mucous as their interior tubular fabric seems to shew.

Lastly to a humor remaining in a receptacle a liquor
generated in another part may be brought by proper ducts
so that from these two liquors which were varied in different
organs a tertium quid or humor of a different kind may be
formed. thus as many examples of this kind of artifice in
the human body. To the chyme or alimentary mash as
it passes out of the stomach is added the bile & pancreatic juice & from
these is formed a new mixture named by the name of chyle.
So in the receptaculum Chyli a white fatty chyle & gelatinous
lymph come together. thus in the urethra the semen from
the Testes is mixed with the prostrate liquor & in some quadrupeds
to the very viscid semen is affunded a thinner humor from
proper glands as to Monro. So in the capsule of the
joints with the gelatinous humor of the haversian glands is
mixed the medullary oil of the bones.

By artifices of this kind a humor in a follicle may be
rendered more dilute & fluid for if the quantity & acrity of the
exhaling arteries be very great the humor residing in the
follicle will be rendered more dilute & fluid. an Example of this

we have in the alvine feces. which increased irritation and
copious flow of arterial humor evidently softens & dilutes.

6 Semen is generated in the follicles.

The humors of the human body an almost all of such a
nature that if kept in the heat of the body for some days
especially if the receptacle is shut & their humidity retained that
they begin to grow and tend to a putrid corrupt nature
this change is one step of providence nature for without it
your humors would not perform their office sufficiently.
Thus the bile in the gall bladder which comes mild from the
Liver is rendered very bitter & sharp. Thus in the seminal
vessels the semen coming from the Testes is yellowish & their
but it becomes a more saturated fetid liquamen. The milk
also by stagnating from cruds will turn bitter & the mucus
pudendi muliebris will become acrid.

7 The follicles retain the humors & send them out at fit times.

The humors are collected & retained in the follicles receptacles
that they may all be sound out at one & the same time
which time indeed is adapted to the conveniencies of animal
life. Thus are Examples where a quantity of useful humor
is required which without the intervention of follicles to collect
it, it could not be supplyed soon enough & in sufficient
quantity to answer the uses of life. Thus the Semen is
necessarily deposited in the seminal terminales that it may
ejected in a sufficient quantity with a sufficient momentum

through the long vagina & in quadrupeds the very long uterus so that the strength of the semen may reach the ovaria and thence cast out whatever is the element of man.

Thus it is probable the bile is collected in the gall bladder that it may be effunded more copiously into the duodenum in the time of Digestion at which time now is most need of it. So also mucus is collected in the follicles & crypta of the larynx, pharynx, the Intestinal canal & in the cells of the uterus &c. that it may be supplyed more fully in the time of speaking, swallowing, discharging of the fæces &c.

But the follicles serve other useful purposes. to remove the foetid humors much as are ungrateful to the senses that they may not perpetually flow out & discommode our bodies which are formed for civil society. Thus the urine is stayed in its proper bladder, the cerumen in the large interstices, the mucus in the Nose & the semen in its vesicles.

The Humors are evacuated from the follicles by the acrimony & quantity of the same more powerfully irritating their nerves & thus soliciting the evacuating power.

Thus it happens that our humors are not retained beyond the fit quantity for the ends of Nature nor beyond a certain degree of acrimony nor so as to hinder the conveniencies of life. but at length every humor is brought to its destined place

The irrepressible power of the stimulus by w.ch humors although mild solicit their excretion we are taught from the intolerable necessity we are under at certain times to sneeze cough, go to stool, make water that we may free the body of the retained humor. But by what mechanism this excretion is obtained it behoves us to shew.

A muscle is that part of an animal body w.ch wherein irritated contracts. Nature has bestowed on the follicles a muscular fabric for the most part conspicuous tho' in some part more visible than our senses which by extension, acrimony, dentition alone, or the strength of imagination expells the humor from the irritated follicle.

The muscular fibres are adapted in divers manners to the follicle, some are united into the fabric of the follicle itself, others are placed circularly round about it & as it were at a distance from it that they may empty one follicle or the whole system of glands together

We can see proper muscular fibres in the larg receptacles. nay the Stomach, Intestines, vesica urinaria, uterus are undoubtedly emptied by means of their muscular fibres, although some men doubt it yet it is confirmed by a host of experiments

In the smaller follicles every thing is smaller neither can muscular fibres be discovered in them by the eye or the grosser experiments with a needle or scalpel, nevertheless in the same

vane follicles chemical acrimony discovers an irritable power which moved on alering stefron wonderfully auelerates the excretion of these humors. Thus Entrines discharge the mucus from the cryptæ of the Nose, masticatories from the glands of the mouth. Gargarisms from those of the fauces & acrid Purges from those of the Intestines.

Again Nature has provided another very powerful manner of vacuating the very large receptacles viz By being ouerspred very way with large muscles & adjacent Viscera that ve the whole cavity with other parts containing the Receptacle are ve narrowed that it together with the follicle are powerfully urged against & expressed. Thus that very powerful muscular stress the Diaphragm with the obliqe & transverse muscles of the abdomen very powerfully discharge the contents of the uterus vesica urinaria, & vesiculæ seminales Thus the Levatores Ani girting the vesiculæ seminales press upon them &c.

Thus are not examples wanting of the absence of glandular cavities through which they may be evacuated being every where befordershut, Thus the cavities of the Joints & also the large mucous cavities which retain the Synovia have no opening to emit the same, of this kind

also

also is the vaginal cavities of the Tendons, the renal capsulæ, the chambers of the Eye, the ovula Graafiana, perhaps the ventricles of the Brain, the cavities of the pericardium, pleura, breast, abdomen, amnion, adipose cells, funiculus umbilicalis & others: In these examples the secretion is compensated by the venal absorption of the same or otherwise dissipating it as fast as it is deposited by the exhaling arteries.

The various conditions which have been enumerated and are said to influence secretions may be differently combined both in regard to degree & number.

Whoever considers with attention the various conditions of a secretory artery, both in its trunks & branches, the different density of the secretory orifices, the straight or winding direction of the vessels, their anastamoses, the plicæ or folds in them, their length, or shortness, together with the irritability of them & the changes produced by stagnation, resorption & exhalation will readily allow that the secreted humors may differ in a manifold manner.

Haller has shewn in his commentaries upon Boerhaave's prelections that from only ten different conditions variously combined 1023 kind of humors may

be generated, as from the various combination of 24 there are almost infinite variety of sounds may be produced.

A compend of the preceding account of Secretion.

Let us now contract into a short compend what appears to be the most probable parts of this subject & most free from new speculation that we may examine it at one view.

It has been shewn that there are in the blood particles of the same nature as are found in the secreted humors, or at least that are disposed to acquire that nature. There is found in the blood water, a coagulable lymph or gelatinous humor, an imperfect mucus & viscous fluid & an adipo or fatty fluid not fully perfected.

That all these may be separated from the blood is but reasonable to suppose, as well because there are orifices of vessels of a smaller size than the red globules of blood, thro' which whatever is more subtile than the blood must necessarily be separated; as because the more viscid particles betake themselves spontaneously to the sides of the canal & are drove thither by the more weighty & solid blood globules that prevent their motion.

in the axis of the vessel; & lastly because the motion of the blood being retarded the mucous the gelatinous & oily particles begin to attract each of them like particles to themselves.

But the more they coalesce, the more unfit for motion they become, & thereby adhere more to the sides of the vessels & to the small lateral orifices, in the same manner as the lymphatic discharge from the nostrils, lungs, or urethra upon any violent irritation cleaves to the sides of these passages.

Moreover of these three humors, the adipose particles enter the largest orifices & the shortest canals, such orifices & vessels as present themselves to sluggish & thick particles; thus they are deposited by means of simple pores into cells, for such an inert fluid could not overcome the resistance of long & narrow vessels. Whilst they stagnate in their cells these particles unite more closely. In these receptacles the adipose parts separate from the water & lymph that were mix'd with it, & which are carried off by the smaller absorbent veins. Thus it is collected pure.

The coagulable humor goes off from the blood & enters into orifices of vessels of smaller size than the pores are which separate fat, & consequently smaller

still than the orifices which receive the red blood. It passes likewise with water into the cells of fat as they are large enough to receive them, but they pass out by forming large ens' to receive them but too small to admit the particles of fat.

The fat being thus secluded & the water being absorbed, at length that humor remains alone in its proper vessels wch has the properties of the white of an egg. As it is heavier & at the same time more fluid than the mucus it finds its way through larger excretory ducts when neither the fat can reach nor yet the mucus. It is also separated from the fat by absorption.

The passages of the mucus seem to be smaller than those of bil or lymph, but when the velocity of the circulating fluids is much increasd perhaps the lymph too may sometimes enter them. These passages are commonly short & open into small follicles at no great distance.

It is probable that the mucus is produced from a winding or long capillary artery that rises at a great distance from the larger trunks. And if

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it is generated without the interposition of a follicle
it is likely it must then be from smaller & longer arteries
that curl very much, so that by this structure the
more viscid particles have time enough to coalesce. The
lenticular or viscous which was small at first in the
aqueous particles may be perfected at length in a follicle
or long excretory duct by a deception of the water and
attraction of similar particles.

The aqueous humour shaft of by the more subtile
vessels, such as are fit to receive neither mucus,
coagulable or fatty particles so long as the vessels
destined to that office are in an entire healthful
state. These watery particles are separated or
strained off from a red artery, or an artery less than
what carries red blood, or transudes thro' the sides of
the vessels or lastly it is exhaled from the other kinds
of fluids. It appears reasonable to conclude that
the fistulæ designed for the aqueous humor are exact
& arise under such angles & conditions as are most fit
to preserve their velocity a long time & which are quite
free from any remora or obstacle because this humor
is so fluid —

when these four kinds of tumors are drained off scarcely any thing remains in the red artery but red blood, the globules of which are such as could not enter into the smaller orifices of vessels & which being a more solid fluid is made up of particles that are fitter to preserve their celerity by keeping the axis of the vessel & overcoming the density of the small arteries which shut out other lighter humors.

The water & the other kind of fluid humors do not however wholly leave the blood in those extremities of the smaller vessels; for though by the help of a microscope it may be seen that the diameter of a single red globule takes up the whole diameter of the capillary vessel; yet it is seen at the same time that the thread of these globules is broken & interrupted by the interposition of particles of a less order, which however from their transparency & minuteness are not visible.

Examples of viscid humors
the Bile and Semen.

This chain of reasoning may perhaps be rendered more agreeable if we intersperse some instances of

Secretion to illustrate what is advanced; it may render the subject more easy to be understood by those who are not conversant in forming general & abstract Ideas distinct from particular objects. Therefore these well known conditions conspire in the generation of bile which is a viscid & at the same time an inflammable fluid.

1st The blood comes to the secretory organ, the liver fit for supplying a viscid oily & acrid humor that is full of oil, the elems a vapor of the abdomen, the putrid quality of the intestines to pass over the hitherto unknown effect of the Spleen)

2ly This blood flows very slowly that the viscus destined for the secretion of bile along a canal very remote from the heart & separated from the arteries likewise by the whole series of capillary vessels in all the different viscera & in the membranes of the vessels; its course too is thro' a vein less firm than arteries are, which is made up of the union of veins from all the viscera impregnated with contents from those viscera & the bile an artery divides into large branches & them into smaller ones, which however when taken all together are much

larger than the trunk.

3.ly The excretory duct is small, if it be compared with the sanguineous excretory trunk, rough with rugæ internally & with a circular work that increases the friction.

4.ly This duct conveys the secreted humor to a follicle having but one orifice which forms a difficult passage narrow & ascending, this follicle has a bottom that is blind or stopped up in which the bile can remain at rest, & undergo the powers of absorption, heat & incipient putrefaction, & acquires a new viscidity from the proper mucus of this receptacle.

5.ly From this receptacle the bile is expressed by a strong muscular force, at certain times, however more copiously through a duct almost shut up by valves & is also narrow & reticulated; & likewise is forced thro' the gaps or orifice of this duct which is formed by muscular fibres of the very nobile & irritable intestine, thro' an interval or span of the coats of this intestine laid upon one another, so that there are many sufficient causes to compress & shut the biliary duct, as often as the gut is expanded with air

within, & thereby has its coats closely pressed together, or as the fleshy fibres stimulated by any irritating cause make the intestine narrower. Thus apparently it is brought to pass that an acid bitter humor is separated in the liver small in quantity, viscid & stagnant w.h inflammable matter & which is poured more abundantly into the duodenum at stated times.

It is not to be denyed that there are other conditions besides those just mentioned of which we are ignorant. It is probable however that those already enumerated are so necessary, that if any one of them was wanting another humor different from that of bile would be produced in consequence thereof.

Again: the semen is a particular fluid w.h may more properly be classed with the mucous fluids as it is destitute of inflammable matter.

In the 1.st place then, the semen is secreted from a small but a very long winding artery that grows rather larger in its descent. Which it certainly does in some animals if not in man.

2.dly It is secreted from the blood by such minute branches of small arteries, that by no art whatever

vued any liquor ever yet be forced from the trunk of the artery into the excretory seminal ducts.

3.dly It is depovided into innumerable reflects of the testes which are of an incredible length & are extremely twisted

4.ly The semen flows from thence into a more lax vascular network which may be filled without much difficulty.

5.ly Then it flows into vasculous cones that are more subtle & fine than the preceding & w.ch are twisted into very frequent wraths, & thence in a long small vessel which by frequent folds or repetitions forms the Epididymus.

6.ly From that very narrow duct it returns into the wider canal of the vas deferens which grows narrower again & widens a vaard time in the cells placed under the urinary bladder.

7.ly From thence it passes out through the narrow duct which leads into the large cavernous contorted seminal vesicles. Hlen

8.ly after stagnating there a long time, it is expelled, not spontaneously but by a muscular irritable force & is ejaculated thro' narrow orifices

that open into the urethra.

2.dly In its very emission it is mixed with the white fluid of the prostrate Gland, so as to be increas'd in its quantity & to have rendered more fluid which certainly is the case in some animals.

If we consider all these circumstances we shall find a delay in its passage in the artery, the excretory duct & in its follicules; a resorption in the cells & in the Epididymus, a peculiar fetus upon the intestines which are full of a putrefcent matter, a receptacle quite shut up unless on the excitation of a stimulus by venery. all these things conspire to produce this humor in small quantity, & which has something of a putrid quality from the fetus of the intestines, & by reason perhaps of the first narrowness if the small excretory ducts abounds with very subtile particles.

Now, if we compare these two humors to diff. their properties with their excretory organs it may seem probable that on account of a similitude of structure they have many things in common but there appears to be a difference in the copious oil of the bile & the putrid vapor resorbed from the intestines

intestines which the humors when conjoined grow bitter by stagnation.

In the semen there is less oil & a greater viscosity as there is more of that machinary which creates a vimina; yet there is a greater abundance of subtle particles on account of the first secretory passages being narrower

In the albuminous kind of fluids there is so great a simplicity that by the new narrowing of the orifices that expose themselves to the course of blood, instead of blood lymph only passes, as in the instances of the lochia & of wounds; or again the new dilatation of the pores designed for the albumen may admit red blood (or fat in anatomical experiments) & also in the instance of the serous vapor of the breast, pericardium, & ventricles of the brain & in the lymphatic vessels which so often carry a red humor in inflammations &c

Example in the aqueous humor

If we on the other hand consider the secretion of the kidneys, or the watery humor of the eye, we shall find the artery of the kidney to be very

large, & the veneton to be copious and quick.

2.dly The branches of the artery are very subtle so as to diminish somewhat of the blood's velocity & perhaps to exclude some particles which being vitiated by that litle structure may be resumed by the veins which in the kidneys are very large and of a very lax structure.

3.dly From these arteries that excretory ducts are continued from whence there is a quick & fluid veneton.

4.thly But by a singular example amongst the excretory canals these ducts are of a densest of a compact structure, by which contrivance the light & fatty humors perhaps are excluded & hence perhaps it comes to pass that the acrity of the blood being increased, & from thence the force likewise that impells the particles into the excretory ducts the deeper finds a way into the urinary passages.

5.thly The urine penetted in the kidneys is deposited into a receptacle in which it becomes more acid by retention & more fatid & at a convenient season is expelled with a degree of force & a velocity that

is necessary to cleanliness & ~~salubrity~~ convenience.

All these facts seem to be arised by clear evidence, & deduced from a most probable chain of reasoning so as to be very satisfactory in the explanation of this function.

In like manner in plants which are composed of a variety of cylindrical vessels & all of them filled with a sort of cellular pith from the water which they draw up by their tubes in the roots, a mucous, gelatina and oil, & very subtil odoriferous particles are separated in organs appropriated to those purposes, or that in the petals are generated particles having a fine effluvia, in the tubes gummy & resinous bodies are produced & the vesical particles are assimilated into fruit.

Heads of an Essay entitled
De Anima Medica

Introduction ——
Part 1st

De Anima Medica philologice explicata.

Man made up of Soul & body — proved from universal consent reason & revelation — Soul what? — Various opinions of authors concerning it — The materialists as Democritus, Epicurus, Lucretius &c assert that the Soul is material & perishes with the body — The Saducees amongst the Jews were of the same opinion — Bruno, Vanini, Spinosa & Hobbes amongst the moderns revived this doctrine with some improvements —

Denyed by Plato, Socrates, Cicero, and most others both ancient & modern — The immateriality of the Soul proved from reason & scripture — nature of the Soul unknown to us except

form of its properties as perceiving willing
judging reasoning &c. — The manner
of the Union with the body unknown —
Sentiments of authors thereon — Leibnitz
— Locke — Watts — How
the Soul acts on the body is likewise
unknown — Difference between
the Soul of man & Brutes — Remarks
on the Anima Brutorum.

All the vital motions owing to
the influence of the Soul evident from
the vis inertiæ of matter and bodies
just Dead. — The Soul then is
the impetum faciens in all animals —

As the Soul acts on the body
so does the body act on the Soul —
proved from Diseases, injuries, pathemata
animi &c: — Authors differ in
opinion as to the extent of the Soul's
influence on the body — The
Pros of Hippocrates — Archæus
of

of Van Helmont — Kepler —
Stahl, who calls it the Anima Medica.
Likewise Mead, Potterfield & Nicholls.
The same Doctrine is in some measure
adopted by the present professors at
Edinburgh, particularly by Dr Cullen
under the name of the influence of
the nervous system, — Opposed
by Citizen, Bellini, Friend, Hill,
Boerhaave & other mechanic writers —
— Animadversions on the same.

Part 2d

De Anima Medica physiologice explicata

A consideration of the influence
of the Soul on the body necessary in
explaining the animal Oeconomy —
animal motion & sensation owing
to the Soul acting on the body through
the ~~influence~~ medium of the Nerves —
manner in which sensation is performed

All motion whether voluntary or
or involuntary depends on the Nerves
acted upon by the Soul — various
opinions of Authors concerning the
causes of animal motion —
Animadversions on the same.

Part 3d

De Anima Medica pathologice applicata

its in Health so in Diseases
the influence of the Soul on the body
evident in the production of Fevers, or
pain — the efforts observed to remove
morbific matter or any offending cause —
in critical evacuations — the
Crises of acute Diseases — expulsion
of any foreign body — Death.

Of Secretion

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Chemical Tracts

1st Of the Expansion of Bodies by Heat

2d Practical Chemistry or directions for making sundry chemical preparations

3d A compend of the Theory of Chemistry unfinished

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Of the Expansion of Bodies

The expansion of Bodies by heat & their contraction by cold supposed to proceed always uniformly by equal augmentations or diminutions of heat, appear to have sundry irregularities; a remarkable one is observed in the freezing of Water. Though water shrinks more & more as its warmth diminishes, down to the period of its congelation; yet, at the instant of its becoming Ice, it expands into a larger volume so as to burst the strongest vessels that have been employed for confining it. The floating of Ice in water is a necessary consequence & a convincing proof of ice being less dense or more expanded than water in its fluid state. Mr. de Marian in a dissertation on Ice attributes this increase of the bulk of the water chiefly to a different

arrangement of its parts; the icy or hoar
or water being composed of filaments
which are found to be joined constantly
& regularly at an angle of sixty degrees
which by this angular disposition
occupy a greater volume than if they
were spherical. He found the
augmentation of the volume of water
by freezing in different Trials 1/4 1/10
1/19 & 1/22 part; that Ice, even after its
formation, continues to expand by cold.

Essential oil of Roses

Take a quantity of Sahash rose leaves, just them into a proper vessel with a sufficient quantity of water adding some mineral acid as Spirit of salt, vitriol &c. In this menstruum let the roses be digested for 15 days; after which put the whole into an alembic & draw off the water with a pretty brisk fire. But instead of the common recicver a separating glass must be placed under the nose of the worm & a reciver added to the tube of the separating glass. By this means all the oil will float on the surface of the water in the separating glass & may be easily separated from it, & then the Operation is finished.

This is looked upon as one of the most valuable perfumes in the world.

Simple Cinnamon water

Take a pound of the best cinnamon ground powdered digest for 24 hours in 2 gallons of water put the whole into an alembic & draw over one gallon with a pretty brisk fire.

Castor water

Take of Rose's Castor an ounce, of water three gallons; draw off one gallon with a pretty brisk fire

Both Hungary & Lavender water may be made at any time extemporaneously without distillation, by mixing the oil of the plants with highly rectified spirit of wine.

To make red Ratafia

Take of black hart cherries 2 1/2 pounds; black cherries 4 pounds: raspberries & strawberries of each 3 pounds: Pick these fruits from their stalks, & bruise them, in w: condition let them continue twelve hours: press out the juice, and to every pint of it add a quarter of a pound of sugar. When the sugar is dissolved run the whole through the filtering bag, and add to it three quarts of clear proof spirit. Then take of cinnamon 4 ounces, of mace an ounce, and of cloves two drams; bruise these spices, put them into an alembic with a gallon of clear proof spirits & two quarts of water, & draw off a gallon with a brisk fire.

Add as much of this spicy spirit to your Ratafia as will render it agreeable to your palate; about one forth is the usual proportion.

The fruits should be gathered in the height of their respective seasons, when fully ripe, and the largest & most beautiful of them chosen for the purpose

The above is called fine soft or sweet Ratafia some however prefer the dry or sharp ratafia on acc: of it's tart flavor

To make tart Ratafia

Take of cherries & gooseberries of each 30 pounds; mulberries 7 pounds: barberries 10 pounds. Pick all these fruits clean from their stalks &c: bruise them and let them stand 12 hours; but do not suffer them to ferment. Press out the juice & to every pint add three ounces of sugar; when the sugar is dissolved run it thro' the filtrating bag, & to every five pints of liquor add four pints of clean proof spirit: together with the same proportion of spirit drawn from the spices in the foregoing composition —

Of white Ratafia

Red fruits are the basis of that called ratafia so, on the contrary that made from the juices of white fruits is denominated white Ratafia —

Ratafia of Peaches

Take your peaches, bruise them, & instantly strain out their juice thro' a fine of strong linnen. To every pint of the juice add a quarter of a pound of sugar, and when the sugar is dissolved half a pint of spirit. No spices must be used in this Ratafia, the fine flavor of the peach being far preferable to all the spices in the world. The quantity of either the sugar or spirit may be

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augmented or lessened as you see fit.

As soon as the spirit is added to the dulcified juice of the peaches, the whole must be filtrated thro' a flannel bag, & put into bottles closely stopped; for the fine flavour of the peach will soon be lost unless the bottles are very well corked.

If you would have your Ratafia of a bright red color, you must let your bruised peaches ferment a day or two; by which means the color of the skin and that of the flesh near the stone will be extracted and give your ratafia the color desired —

All spice

Take of pimento, carraway & coriander seeds & lemon-peel of each 3 pounds: of malt spirit 11 gallons; water 3 gallons. Draw off with a gentle heat, dulcify with ordinary sugar & lower it to the strength you desire with clean water.

Geneva

Take of juniper berries 3 pounds; proof spirit ten gallons; water 4 gallons. Draw off by a gentle fire till the spirits begin to rise —

Compound Gentian water

Take gentian root sliced 3 pounds: leaves & flowers of the lesser centaury of each ℥viij: infuse the whole in 6 quarts of proof spirits & one quart of water until draw off till the faints begin to rise

dr. ether — 1 1

The method of making potashes in newengland —

Thew is very little wood burnt on purpose for this work, greatest part of the Potash being made from the ashes of wood burnt in common chimneys for domestic uses. The woods chiefly employed of the hickory, oak, beech, birch, elm, walnut, chestnut & maple. different sorts are burnt together, old & young, green and dry; and if one sort should sometimes be burnt by itself, the ashes are not kept seperate but put to the same heaps with others. It is said by some that a ton of Potash is obtained from 400 bushes of ashes; by others from 450 bushels; by others from 560 of the best, & double the quantity of the worst. most commonly from 700 bushels: × some thinks that the beech yields most salt, others that the oak yields most & the walnut least; but that the difference is not great.

× From an assay made by Doct: Morgan on common ashes about half a pound of potash may be obtained from a bush of ashes —

The ashes are collected from the country people in winter, and laid in heaps under sheds, or in other convenient covered places till may or June; not that they are supposed to be any ways improved by keeping but because the Potash manufacture is carried on during the summer only, the frost rendering the elixation impracticable in winter; at the time of using they are moistned with water or weak ley to lay the dust.

The ley is made from the ashes in tubs or vats, the dimensions of which are said to be 8 feet by 10 and 10 inches deep; & three of them that are set at once to hold 500 bushels. & three vessels of such dimensions are scarcely equal in capacity to 300 bushels, the ashes must either be rammed down hard, or heaped above the sides or both. Some water is poured on the top, and as fast as it soaks in, more water is put on. According to some the water is suffered to stand for a week on the ashes; according to others it is not stopped at all* but runs out as soon as it has gone

* Acc. to Lewis's experiments the strength of the ley is increased by standing some time on the ashes & also by cohobation

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penetrated to the bottom in a small stream of a dark brown or chocolate colour. They continue putting more water on the ashes, till by the color & weight of the lye, it is judged that all the salt is extracted. The first layer, & as is thought the second also, are convey'd into a cistern to be boiled down, the others are reserved to be poured on fresh ashes.

The lye is boiled down in iron pots, some of which hold 60 gallons tho' many are less, and some are said to be so large as to hold 80 gallons. Two pots are hung together in brick-work in such a manner that the fire acts upon the sides as well as upon the bottom. The bottoms are subject to crack or split. It is said that some persons in America having contrived to cast them with the bottoms downwards so that the bottom is formed of the heaviest and most solid part of the metal this inconvenience is in good measure prevented.

As the lye evaporates, more is added in, a gallon or two at a time, till the pots are judged to have a

sufficient charge of salt. The salt in becomes dry, grows so hard, & sticks so firmly to the sides and bottom of the pot, as not to be got off without much labour; but accident has lately discovered to the manufacturers a method of avoiding this most troublesome & tedious part of the process. Instead of waiting till the pots are grown somewhat cool, and getting out the salt with mallets & chisels, as formerly practised, they increase the fire till the pot becomes red hot & the salt melts: in which state it is conveniently taken out with iron ladles, cast either on a dry floor, paved on purpose, or in old iron pans. Before fusion the salt is brown; in fusion it turns of various colors, blackish, reddish, &c. Some suspect that a little common salt is added to make it melt more easily.

Production of gypsum or plaster of Paris by a slight calcination of the gypseous stones

Take any quantity of the gypseous stone call'd plaster of Paris Stones or Alabaster, & expose them to the heat that will make water boil. A slight exfoliation will then ensue, and as the moisture they contain exhales from them, the stones will gradually fall into a powder of an impalpable texture, which will be the gypsum or plaster of Paris —

Observation

The true plaster of Paris produced as above, on the addition of water in the proper proportion acquires a paste-like tenacity; but less than that of the argillaceous earths or clays; & if more be still added the plaster will no unite with it that it may be cast into molds; & will run freely into the minutest hollows like homogenous fluids. It is from this quality & its concreting with the water without shrinking or diminishing its volume or growing dry into a tenacious body of moderate hardness applied with great advantage to the casting figures. It is used also commixt w. lime for the plastering ornaments of ceilings sides of rooms &c: under the name of Stucco; or simply in a peculiar manner, under the name of terras for making floors.

Production of lime, by the calcination of calcarious Stones

Take lime Stone & burn it, in a strong fire for the space of two or three hours: it will then be converted to quicklime; which if required to be kept in that state for use or experiments, must be preserved in bags or other such manner as may prevent the air, or any moisture from having such to it.

Observation

Lime, being produced according to the process of this experiment, or in any similar manner remains in the form of a caustic stone: & has an extremely strong corroding power on any organized part of animals or vegetables. Being mixed with water it instantly attracts & absorbs it with great rapidity: a very strong heat being generated by this union or action on each other. When it has imbibed the full quantity of water it attracts, it looses its coherion & falling into a pulverine state is then said to be slacked lime

Of Salts

1 Production of the veg: fixt alkaline Salt by infusion of the parts of vegetables — vid:

2 Production of vol: alk: Salt by incalescence

Take any solid part of an animal; or any quantity of blood or urine evaporated to thick consistence, & put it into a retort properly coated with lute, draw the retort in the open fire in a proper furnace & fit on a very large receiver with a long neck having a very small perforation which should be turned horizontally. Kindle then the fire, but without letting the receiver be cool, continue it so till the matter in the retort begin to burn, wch may be known by the white fumes & fetid smell. Take off then the receiver having emptyed it of the phlegm, clean it again & make good the joint with lute

Proceed then to bring off gradually the salt oil & phlegm that will arise from the matter in the retort, taking care not to urge the operation too fast &c

Elucidation

The salt thus produced will be dissoluble in all due quantity of water & by adding very gradually a small quantity of spirit of urine to the solution may be made to form itself into regular crystals of a moderate size

It does not appear from any thing hitherto known that vol: alk: salts can be originally obtained by art from any other substance than the product of animals vegetables

They are obtainable in greater or less proportion from all animal substances, but only from some particular kinds of vegetables

3 Production of volatile Salts by putrefaction.

Volatile alk: salt produced by this method will be the same as that obtained by incalescence

4 Conversion of fixt into volatile salts

Take of the coal of blood made by evaporation in any close vessel & fixt alkaline salt in the proportion of ½ of the fixt to one of the other. Mix them thoroughly by pounding them together, & then put them into a coated retort, & place it in an open furnace. Give them a moderate degree of heat at first, & afterward raise it as high as the vessels will bear & when the matter appears to grow cooler though the heat be kept up in the furnace the fire must be suffered to go out & part of the fixt salt will be found to be changed into volat: alk: salt & rised into the receiver

what is commonly calld calcareous earth is generally doubted whether it be of a calcareous nature or not; but as it appears to have the properties ~~of~~ expected to Selt: it is by some considered as such under the name of calcarious Salt combined with the fixed alk: Salt it forms the Sal Saponarius or caustic alkali of antichymists

This transfered to plain book

To a compd. Salt formed by the combination of fixed alkali & Arsenic —

Take crystaline arsenic & add it to a boiling solution of an equal quantity of fixt alkali. Evaporate the mass to dryness & keep it in a close vessel secured from the air.

Decomposition of the solid parts of animals by the action of the gelatinous matter or hydrothionic water

Take any of the membranous parts of animals & boil them along time in water, & then drain off the gelatinous fluid through flannel. This fluid being insipissated by evaporation till it acquires the consistence of a jelly when cold is called size, & when fluid from humidity is agreater degree glue — by the same operation isinglass is obtained from a particular kind of fish

Tinct: & Extr: of Castor

Take ℥ij of Castor, & powder it; & then put it into a phial & ℔ a quarter of a pint of proof Spirit of wine. Let it infuse 10 or 12 days, sometimes shaking the phial: & then pour off the tinct: from the faces. Add then half a pint of water to the tinct: put into every long vial, & the extract of the castor will be precipitated, & may be separated from the diluted Spirit by decantation and subsequent filtration tho' paper coloured with alcanna cloth put in a small glass funnel

In a similar manner Bark Civit & other animal part of similar kinds containing matter of a similar odour or flavour may be made to afford the substance in w. the similar qualities reside by extracting them from the fibrous & vascular substance by a proper dissolving medium. In most cases it is rectified Spirits, the similar substance being for the most part of the same nature with the essential oils of vegetables

The epispastic matter of Canthardes is no exception to this: for it is wholly soluble in Spirit of wine & notwithstanding what some writers assert to the contrary for a tincture in that vehicle will blister as expeditiously & as much part w. equal a quarter pound than the substance of the fly itself. It is true that an extract may be also made

through coction in water, but it is by the mediation of the
heat w^ch liquifies it & brings it out of the vessels of the animal
in w^ch it is inposited: for on cooling of the water a separation
will be found to be made of the exhated matter from it.

To Exhaust the colorific or tinging matter of
animals: instanced in cochineal —

Take a solution of any alkaline salt either fixed
or volatile & add to it cochineal powdered. Let the
mixture either stand for two or three days, if it be formed of
the volatile alk: salt, or boil it for half an hour or more if
it be the fixed, & then filter it through paper. The
colorific matter may by this means be separated from the
other parts of the cochineal fly, & it may be precipitated
by the addition of any acid or earthy salt.

Elevation

By the same means any colorific matter or dye may
be exhausted from other animals or parts of animals in w^ch such
may be found: alkaline salts being agreeable menstruum of all
tinging animal & most tinging vegetable substances!

This process is principally used in cochineal w^ch pushed with
or other solutions of volatile salts for the forming the
scarlet & other dyes: as also for making the pigments
used in painting called carmine & lake: which are only
this & other such colorific matter precipitated together with some
kind of white earth w^ch serves as a basis or body to the tinging
particles.

Notes on Chemistry

Chemistry is allowed to be a branch of Natural Philosophy
or according to Logicians Philosophy is the Genus of wch this is
a Species the difficulty then is to find out the marks which
distinguish this Species wch Dr Boerhaave gives in his
Method Studii Med: published by Haller wch we adopt (vid.

Dr Cullen defines Chemistry to be that part of
Nat: philosophy which treats of the particular properties of
bodies.

Here then it may be proper to distinguish between the gen: & particular
properties of bodies

Thus Bulk, vis, figure, form, gravity, motion &c.
belong to every kind of matter & are therefore gen: properties

The particular properties are those wch belong to certain
bodies & them only, as the ductility of Gold, hardness and
frangibility of a Diamond elasticity of Iron &c

From hence we see that the difference between these two distinct
branches of natural philosophy the former or mechanical part
sometimes called mathematical philosophy being only conversant in
the general properties of bodies while the latter or chymical philosophy is
employed in treating of their particular properties hence it is that
the general properties of bodies is always Synonimous to their
mechanical properties, but where we use the term particular

properties we mean always the same as chymical properties &c.
is necessary to be attended to — thus for Example a Knife or
Wedge if we neglect the consideration of the matter of which
they are made & only take notice of their sized shape figure &c.
this is a mechanick consideration as it may be applyed
to all knives & wedges of whatever matter they are made; but
if we want a knife or a wedge for a particular purpose very
sharp we find all matter will not answer this end therefore
we must take into consideration the particular properties of
matter in order to find out some body endowed with this
necessary property as Iron or Steel is this is an object of
chymical philosophy

We ought to be very attentive in order to avoid
mistaking properties, & considering them as chymical &c. are
really gen.l or mechan.l properties.

Some alledge if we had a sufficient deg.e of heat
all bodies would become fluid as we know Diamond may &
they further alledge that all fluid bodies may become solid
if we had a sufficient degree of cold as some late experim.ts
since that mercury may be reduced to a Solid state by mean
of a certain degree of cold. but this opinion is not sufficiently
examined by a full Induction; if so we should then consider fluidity &

Solidity not as particular but general properties of bodies,
but whilst this induction is not fully proved & some bodies always
continue Solid & others perhaps fluid it is sufficient for us to
consider them as chymical or particular properties

Perhaps it may be objected that the particular properties
of bodies is only owing to general properties variously modified
Such produce the particular properties if so then an addept of
chymistry is false? to remove this objection of the corpuscular
Doctrine, tho' I allow that particular properties may depend
on some gen.l properties, yet since they have not yet made it
plain that they can be referred to any gen.l properties of
bodies we may continue our definition & especially as the
particular properties w.ch we are to treat of are widely different
from any thing we can trace in genichal or gen.l properties.
so that our distinction & definition of the proper subject of chymistry
is very proper & seems to have a good foundation in nature.

The end of natural philosophy is to know the causes of
effects so as to be able to induce or destroy properties as the necessity
of life may require (vid Lord Bacon)

The end of our Study then is to learn the causes of effects &
tis now well known this can only be done by an induction of particulars

Our first step then is to learn the particular facts, these all
Some may be reduced to two heads 1.st History of facts 2dly
of manufactures

2.d philosophical knowledge of Causes.

In a course of chymistry it is necessary 1.st to premise a general account of the objects of chymistry explain the terms &c. we made use of in that Science or as it were make you acquainted with the language of chymistry w.ch is often remote from the language of common life, or of any other Science. Then 2.dly give a general account of the operations & Instrum.ts of chymistry, thirdly the chymical history of bodies

Of the 1.st the objects of chemistry

Here we ought to be conversant in considering the distinct. of natural history — accuracy of division & proper definition of Genus & Species were that most part of Science than anything else; nothing should be wanting to understand this, or in it depends the knowledge of what is to follow w.ch otherwise w.d be unintelligible

This part of our work cant be compleat but by an Induction of all the properties w.ch is the business of the 3.d part, how by we mean a general Idea to be rendered now compleat afterwards

we are under an necessity to a more exacting method

With regard to the 2d part one use of it is that it will
now as a necessary preliminary for understanding the 3d or the chymd.
Operations of bodies. it may further serve as an introduction to
the practice of chymistry since a knowledge of the mean: by w.ch
the qualities of bodies are changed gives a necessary step toward
understanding the causes we may hereaf.r what advantage it is of to
the Theory of chymistry

Always carry in your distinct Idea, Wherein you will
have without understanding, Therefore the 2d part w.ch an introductory
to the 3d. or principal part is in all cases to be considered as fundamental

The doctrine of qualities is one of the principal ends of
chymistry yet in the present state of chymistry it is not possible to go
any thing compleat on it; we shall only touch at the history of
the quality of fusi.n it is one of the most leading qualities

[illegible] numerous of nature
of bodies are really divisible to a most amazing minuteness

Having said thus much of Chymistry in gen.l we now come to be a little more particular in the 1.st part. viz.t

1.st Of the object of Chymistry

Some have tho.t they might be called the Subject of Chymistry but we affix this term as more comprehensive taking in the understanding of meditation & how to subject them to any operation.

The 1.st they'll endeavour under this head is to explain the Terms us.d cause in a more gen.l manner

D.r Boerhaave has attempted to give a definition of the proper object of chymistry but neither his nor D.r Shaws definition of every body within our power proper because all bodies are not so in all circumstances — but all bodies are the object of chymistry in as far as we consider them subject'd to particular properties

The object of chymistry may be considered as Simple & compound or as Single & Collective

As to the first it is the same as elements & mixts wch we chose either to use, & as bodies are element or mixts they come under the observation of Chymistry

Bodies extended are divisible as imponderable as mathematicians have shewn, & by observations of nature refined bodies are really divisible to a most amazing minuteness

as again of Copper into many millions of parts, likewise the
bons of bodies whether fluid or solid or a fluid: or when
in a room spread y^e effluvia thro' every sensible portion of
the same, nor by the most exact balance can we find
the loss of again.

Yet many considerations have led Philosophers
to believe that matter has limits set to its possible divisibility
Thus to avoid disputes with mathematicians we say the
least of matter not further divisible by any powers in our
system we call the Element of bodies.

These never change but all the sensible mixes
of matter are made up of them, or if elements are
different from each other in any thing they are such of w^ch all
large bodies are compounded —

Our argument that these are elements &c does not
change it; If we divide matter we see bodies of particular
form perishing & decaying, yet out of it again a new generation
of form produced in w^ch there is a certain steadiness &
firmness as in animals & vegetables for thousands of
years nor is there any thing new under the sun
they continually pass away & return back precisely the
same

This distinction of form is a division & dissolution,
but when we see them renewed this is assuming together
again a union of the element of bodies. Thus an Oak
is a particular form made up of Atoms of particular form
figure, if they are taken down & no alteration of
size or figure made in them they can be united into the
same stock as before.

So of all bodies they are parts wch not changeable
tho' divided from each other wch nature again brings together

N. B. Newton

Term Element & principles used as synonimous by chemists

A mixt or compound implies 2 or more different
kind of elements united

An union of two or more Elements of the same
or a collection not a compound.

We use the term mixt compound or one & the
same which ought to be observed tho' some writers as
Dr Hook & others make a distinction between mixt & comp.
which is proper for us therefore to explain

According to him then any two Elements united in a
fine what is chiefly called a mixt, suppose we assume fire
air Earth & water as real Elements any two of these united

qui a real mist — thus

Mista prima
or principiata } Study amist

Secunda Compound

tertia &c. Decompound &c

The Arabians say Earth & water qui a mist

call'd Salt Fire & Air another mist call'd Oil; oil & Salt

united make one compound 2 or more compounds make a mixt

2 or more decompounds make a Superdecompound &c

Subdivision of chemical Bodies

Salini substances are either simple or compound

A simple Salt is a body whose different parts we cant discern
altho' it may possibly be re ipsâ not only compound but
a higher degree of composition, if so we cant detect it. Therefore
we use this term relatively to say it is more simple than
another when it is in the greatest simplicity we can obtain it:
for when we resolve any comp.d body into 2 or more we may
say each of these are simple with regard to the body into whose
composition they enter as ingredients & in this sense we use
the term as apply'd to Salts

A compound Salt is a body made up of several bodies
different from each other.

Simple Salts are either Acids or Alkalis &c.
terms however from inaccurate use have occasioned somewhat
of confusion —

Acids are Salini substances vapid to the taste giving
that impression which we call sour or acid & which have the property
of changing Syr.: of Violets & other such vegetable juices of a blue
color into a red

Alkali is a simple salini substance w.h effervesces w.h
Acids & changes the Syr.: Viol.: to a green colour &c

Acid

Not every substance that effervesces with an Acid is to be
not
called an Alkali for Chalk will effervesce with Acids but is
not an Alkali

Of each of these simple salts there are several species

The Acid are the vitriolic, nitrous muriatic (vegetable); there are the 3 general & best known species of Acids &c. I believe there are some other species —

The names are given from the substances &c. we extract the acids most generally from a vitriolic acid, from vitriol, nitrous acid from Nitre, muriatic acid from Muria &c. might have called marine only it would expose to some ambiguity, vegetable acid because obtain'd from vegetables

Alkali are of 2 kinds fixt & volatile

we say a body is fixed or volatile w.r. regard to it habitude in the fire; if it can sustain a strong action of the fire w.t. dissipation we call it fixed; if it is dissipated by a small heat we call the body volatile but these are only relative terms or degrees of quality. There is no middle or exact term to distinguish these but they are placed at such a distance from each other as to be matter of less moment — The smallest heat shewing the volatility of a volatile alkali & the fixed being so in a very great degree of heat, hence the fixed alkali gives no sensible odor whether in a fluid or solid form, but volat: alk: gives a very sensible odor.

These two bodies are called simple Salts because we cant further resolve them & besides as they go into the composition of compound Salts

Compound Salts are those wch have at least one of the simple salts in their composition & an other united to the the simple Salt or to other bodies; which composition retains still the properties of salts

Acid enter into the composition of every compound Salt as one of its ingredients by which we may easily conceive how many compound Salts there are viz. As many as there are substances wch will combine wth an Acid into a Salt wch are three 1. Alkalis 2dly Metals & 3. ly Earths whence there are 3 kinds of ~~neutral~~ compound Salts neutral, metallic & Earthy

Acids may unite with water alcohol oil but do not retain the properties of saccine body—

The neutral Salts sometimes called ~~sal~~ Sal Salsum wch are formed by uniting the 2 simple Salts and Alkali do not change the Syr. of violets in its colour

I shall always use the term neutral to express every comp. Salt made up of Acid & alkali, tho Some writers especially the

the French extend the term neutral to all comp.d Salts —

Of inflammable bodies there are a great variety in nature, indeed there are so numerous that we should be at a loss how to make a division of them but are relieved by this consideration that the property of inflammability in many bodies depends on one substance viz.t if extracted without changing the form of the body as charcoal it would no more be an inflammable body. Hence we may refer inflammability to 3 forms of bodies Oil, Sulphur & ardent Spirits or viz.t the property of inflammation depends in all bodies —

But many chemical philosophers go further and assert that oil, Sulphur & ardent Spirits are each comp.d bodies not altogether inflammable but made up of one body common to each viz.t they have called Phlogiston but by language unsuitable to prohibit the use of phlogiston in its present state. by Oil I mean that modification of inflamation or inflamm.y viz.t we have just explained but we limit it to that.

Oil chemical is commonly obtained in a fluid form — it is an unctuous fluid, inflammable & not miscible with water

Sulphur is a dry solid friable concrete inflammable & not miscible with water

Ardent Spirit is an inflammable fluid body miscible with water

Oils are animal, vegetable or foſsile

Animal vegetable oils are expreſsed eſsential & empyreumatic

Expreſsed are so called because got from animal & vegetable substances by expreſsion being preſsed them by Mechanical or vegetable oeconomy & are easily obtained by breaking down the texture where they are lodged

But this term is very liable to exception as it does not exclude other oils, for eſsential oils may sometimes be got by expreſsion: besides we may get it by other means than expreſsion throwing the body from wch it obtained into boiling water whereupon the oil upon the texture being broke flows out—

The French call them fatty oils. but this term as applicable to expreſsed oils is vcarely as exceptionable than the former as there is an oils analogous eſsential wch have an unctuosity wch is the idea they would convey by calling the former fatty—

Therefore we are obliged to denote them by particular qualities.

Expreſsed oils are mild bland, inodorous & not miable

with ardent Spirit

Essential oils, are said to be taste, of an odor pun=
culiar to the subject from whence drawn & further are
miscible with ardent Spirits —

from their essential oils having the peculiar odor &
often the very taste of the subject from whence obtained
they are supposed to contain the active part of the subject
in w^h the characteristic & virtue resides & therefore called essential.

Essential oils do not necessarily exclude the term of expressed
as the oil of mace is got by expression tho' it has all the properties
of an essential — these oils are sometimes called distilled oils because
commonly got by distillation for that reason also they are called
chymical oils by some.

It was formerly tho^t that essential oils were only
obtainable from vegetables bitumen but it now will known that
it may be obtained also from Musk, Castor civit & other animal
substances

Soft waxy & gums belong to expressed oils, they are unctuous
& by gentle heat liquifiable unctuous & soluble in Alcohol.

Balsams resins belong to essential oils being spontaneous
exudations from vegetables; the resin of spirit or fluid or balsam

but by exposition to the air becomes more solid & brittle &c.
distinguishes it from Balsam.

Empyreumatic oils are distinguished from expressed by being void of the taste of a resinous odor & soluble in Spi: of wine, but not assimilable to resinous oils because the odor & the strong is not in the least resembling the animal. or vegetable which from which taken, under from whatever variety of vegetables drawn it has the same odor called Empyreuma Extracto from the fire employd to too great a degree acting upon & communicating something to it —

~~Fossil bituminous bituminous substances~~
~~all fossil inflamable substances~~

Fossil oils distinguished from expressed & essential by being void of odor & is always in some measure the same Brok similar to any subject from which drawn distinguished from empyreumatic only by experience

To this belongs bituminous & bituminous substances viz all
[all fossile inflamables contain either this oil &c. we have
just mentioned & then are bituminous or contain Sulphur

Then is an oily matter &c. cant strictly or
properly be call'd animal vegetable or fossil but partakes of

in some measure of y^e^ nature of Resin of vegetables & fossils

Ether

Ether then is an oil of unmarkable volatility & inflammability

of a particular odor different from any of the rest & possessed

of peculiar properties

so called on acct. of an infl: fossil oil cont^d^ in them,

they are various, as Petroleum oil is pure in some & others impure

w^th^ other bodies giving it a various countenance

when very pure clear vol: infl: calld Naptha, when

of a little darker color Petroleum; Picelleum is thicker &

darker w^ch^ less smell as barbados Tar

Asphaltum when dryed solid called by

many Bitumen Judaicum

Petroal is of a more hard & stony consistence being fossil

& on w^ch^ its inflammability depends. all these belong to the

Bitumina

There are other Bituminous bodies whose fragrance

is very agreable as Amber & Ambergreas, but have fossil oil

on w^ch^ their inflamability depends

Sulphur is an inflammable body, friable when in a dry
solid form & not miscible with water or ardent Spirit

This is of but one species only in English called Brimstone
in Latin Sulph: & mineral in order to distinguish it from
the principle of inflammability often called in Chymical
language by the name of Sulphur

Ardent Spirit is an inflam: fluid miscible with
water, produced from Wine or other fermented liquors, but
as wine is the subject that most often affords it we indifferently
use the term Ardent Spirit & Spirit of wine —

The term spirit has often been used in every vague
sense as any substance endowed with any great degree of
volatility, penetration or seeming subtlety some have call'd
Spirit, thus they call Ardent Spirits as Sp. Vitriol, Sp. Nitre &c
so an: of volat: Muriat: alk: has been called Spirit as Spirit
C.C. Sp. Sal Ammoniac & 100 diff: substances formerly any:
the name of Spirits; nay some of the essential oils also of
great tenuity & penetration called Sp. as Sp. of Turpentine

when ardent spirit is mixed w. equal quantity of water it
called Brandy if more than half is spirit it called Spirit of Wine
a rectified Spirit, but when we obtain it as pure from water as

possible we call it Alcohol

Metallic Substances are divided into 2 Clases

metals & semimetals.

Of metals there are 7 viz. Gold Silver, Lead, Tin

Copper, Iron & Quicksilver, the last I have added to the

the 6 w.ch is now known is capable of solidity & those very

malleable, but this was only known altho' these few years

by congealing at Petersburg. It was always ranked

among metallic bodies, but hitherto amongst the semimetals

but now we know it is a metal.

Some metals have been found liable to change by

the action of Air & fire, there w.ch do not as called perfect

or noble as Gold & Silver which may be exposed for years to

the Air or hotest furnace & do not suffer any substantial

or alteration of quality; but the other 4 metals do hereof

they are called imperfect or ignoble

Semimetals are 7 Antimony, Bismuth, Cobalt

Zinc, Arsenic, Platina, Nickil,

It was formerly held as uncertain where to place Arsenic

Boerhaave has ranked it among st Sulphurs, but we know

now most certainly that it is a Semimetal or always de-

depends on a semimetal w.ch w.ch it is found

, metals are seldom found pure, but most commonly
in a state of Ore or combind with foreign matters having
either Arsenic or sulphur or both in their composition

Ores then are metals join'd w.th other matters particularly
Sulphur or Arsenic in the bowels of the earth; this union
is per minima

Such ores are commonly united with other bodies on
earth into what we call an heterogeneous aggregate: this
earth is call'd the Matrix of an Ore or of a metal.

Earths are of 4 kind. Absorb. or Calcarious
Crystaline — vitrescent
argillaceous
Salky

1: Absorbent earths are distinguished by their effervescing
w.th being voluble in Acids hence they have been called
alkaline earths

The species of absorb.t earths are Lime Stone
Chalk
marles

They have a property w.ch entitles them to the term of calcarious
to w.t Lucame when burnt they are reduced to quicklime.
chymists falsly imagining all absorbent earths to be calcarious
have given them that name injudiciously as some

absorbent earths are not miscible to quick lime. The notion
ber of absorbent earth is its ready union with Acids —

2dly Crystaline Earths are firm stony concretes always
hard & friable, not soluble in Acids, generally so hard as to
strike fire with steel. taking their name from one species viz:
rock Crystal

These are the bodies usually practised upon with
alkali for making Glass upon this property of their easily
running into Glass they are call'd vitrescent. by naturalists
but the term is improper as crystaline earths are no more vitrid:
than the others without addition of some other body & all
other earths are vitrescent united with other bodies. Mr. Pott
calls them vitrescentes stricture dictæ but crystaline
is a better name

Flint Bristol Stone, pumice Stone, Diamond & Sands
are species of crystaline earths

3.dly Argillaceous Earths are distinguished by not
being obviously soluble in Acids, not striking fire with Steel
being commonly found in a powdery form or in masses w.h
want friability: but besides they have peculiar properties for
if mixed w.h water they acquire softness & ductility & are the
proper subject of Potters wheel w.h can give form to all figures

& being exposed to the fire they acquire hardness hence they afford no vessels from the finest porcelain to the coarsest brick

late discoveries shew that Argilla is composed of the other Calthabus & Crystalline & that it is in some measure soluble in acid but it requires the strongest acid & the assistance of heat.

All the Salts but Gypsum or what has been improperly called are not mention'd the Gypseum or

earths. Gypseous bodies are really calcine'd thin stones not obvious nor are they obviously soluble in water therefore considered as Earths, yet they are thus to be distinguished from earths — They are not soluble in acids; never made ductile or mixed with water, but by mixing them with water after slight calcination they immediately concrete into a stony hardness hence employ'd for making casts & in the foundation of Stucco work.

These gypseous bodies have otherwise been called Selenites &c. is always the same tho' Dr. Hill considers Selenites as a particular form of gypseous bodies; they are generally regular & laid together in strata as the mineral Glass or in fibres also called by Dr. Hill fibrata.

Naturalists commonly distribute fossils according to external habit or marks exclusive of chymical properties, but this has introduced confusion for these Salts & gypseous bodies are compounded together wch are very different.

Salts bodies are commonly supposed to suffer no change by Reaction of the fire & are the Asylum of the ashes; the Alcalies wch is fibrous may, by melting the ingers be spun & made into cloths & made like paste into Paper either of wch are cleans'd by throwing into the fire the stone still remaining as was proved by a subject of the Duke of Brunswick who dedicated a piece he wrote to the Duke on this paper; but late experimts shew that some of these Salty bodies are not so unchangeable in the fire as generally thot.

Earths stones only different by their state of aggregation Earths by stones broke down & Stones only earths whose particles are cemented.

Water; There is but one species of this Genus Lakes pure water as we suppose tho' we never see water pure from something adhering to it therefore we distinguish

water into common & mineral

Common water is such as is so slightly impregnated as not to be discovered by taste or smell or so as to be fit for domestic use

Mineral waters are those so far impregnated as to be discovered by the taste or smell in various degrees

I have now ventured to add a 6th. form that of Acid as different from the other 5 forms

It can be combin'd with other bodies & then loses its property & distinguishes it in a separate state as being always a repellant elastic fluid

We can take notice of species of Air different from common Air as much at least as other water is from pure, hence we call Air common & mephitic

Comm. Air is indispensibly essential to the support of flame & of living animals

Mephitic Air destroys both flame & the life of an animal as the Grotto del Cane in Italy so called because dogs thrown into it instantly expire; the vapors that arise from hence are called mephitic from whence I take the term of mephitic Air —

Gou
water,
solubl
cooly
liquor

Gold is a yellow metal extremely ductile, above 19 times heavier than water, fusible in a low white heat; fixt & indestructible in the fire, not soluble by any of the simple acids, in the common ways of making solutions; only dissolving in a mixture of the nitrous & marine acids into a yellow liquor w.ch stains the skin purple

Of the operations of Chemistry

All the changes in the qualities of bodies are
produced by Combination or Separation.

Others have begun the same way, but have confused
mechanical & chemical operations

The latest writer on this subject is the Swede Wallerius
who is contained of this as Filtration, Pulverisation
Lixiviation Elutriation, Colation, come into his list of
chymical operations which are plainly mechanical

In how many of these are performed in the chym.
Laboratory subservient to chymistry those are to be noticed
as far as they are subservient thereto but it not necessary to
enter into the fundamentals of them

Chymists have attempted to arrange all operations under
the effects w.h are consequent thereon as Salification &c: but this
cannot be done with any advantage as we should have almost as
many heads as there are operations

The only useful purpose we can answer is to range
operations as they are performed in different manners by a
different Enchiresis & require different Instruments & powers, thus
the heads of combination & Separation lead to three different
Instruments & powers

Of Combination

Combination depend on attraction which is that power

by w.ch bodies approach & combine with each other; this always depends on fluidity either in a state of solution or fusion.

Solution is when we employ bodies fluid by water fusion when we use the fire in order to procure the same

Attraction is a term which many foreign writers object to, therefore it must be explained.

Every tendency or propensity of bodies to approach each other so as to unite & remain united or cohere is called Attraction

all bodies belonging to this terraqueous Globe have a tendency to approach the center of the earth &c. is called attraction of gravitation as well as the planets the sun &c. pursued in their orbit by other causes.

another attraction is that between the Load Stone & Iron &c. if such in particular circumstances will always approach each other & is call'd the attraction of magnetism

attraction of electrics is the tendency of other bodies to move towards electrics & electrics to other bodies

a fourth attraction is supposed to be that of cohesion in which the particles of bodies remain united solely with each other & this attraction &c. I mean now principally to speak of whenever I dont specify otherwise, as two drops of water or globules of mercury being in contiguity run together & form one drop & one globule

all the parts of Aggregates are instances of this attraction & that there is such a power no body denies only

the propriety of the Term wch is only employ'd to express some universal fact from the paucity of Language

'tis true the Term seems to imply some inherent power drawing them together, but it is only meant to denote that there is some power forcing them together & keeping them so whatever it became

Tho' philosophers may cavil against this term yet they have all invented other terms to express the same thing Bellini calls it Nisus in contactum, Fermad calls it magnetism de corps; the latest french writers call it affinity & Mr. Read calls it Relation of bodies —

The business of the chymist is to put bodies in such circumstances as is necessary for this attraction to take place wch circumstances are to be enquir'd into

It is agreed the attraction of cohesion never takes place but in a certain contiguity; some calculate this power to be in a reciprocal inverse ratio of the distance, but pulleys this is attempting to calculate what may not admit of calculation exactly. however it is agreed that the distance in which the attraction of cohesion can take place must be very small as to appear to our sight to be in contiguity.

Gold is of greater Specific gravity than iron therefore contains more matter under the same bulk, but it does not thence follow that the cohesion is stronger in the particles of gold than of iron but the reverse obtains: so that

this attraction is not according to specific gravity we once
have imagined since God the heaviest & other one of the
lightest have an attraction for each other. most probably
the attraction depends on Regions of the bodies presenting
new points of contact with each other, This is illustrated
by a common Experiment in the schools of Nat: Philosophy
2 hemispheres of lead applyd to each other by their convex
surfaces do not unite, but if their plane & perfectly even surfaces
be applyd with a little force they unanimites. The
perfect sevings to bring near the prominences so as to
present more points of contact & according to Leibnitz
the cohesion will always be greater unless the prominences
& cavities answer exactly

Whenever perfect roughness may exist yet as all
bodies do not admit of a most perfect perfect smoothness
cohesion unless a fluid be interposed &c. gives a greater
contiguity & so fluidity is the circumstance required
in order to procure the attraction we want & on which
it depends.

I don't say the explanation I have given of
this matter is fully satisfactory: some doubt whether there is
a further theory necessary or that fluidity or velocity has
something further favouring or not favouring the action of bodies.
whether this be true or not yet fluidity seems to be a
circumstance minutely necessary in order that the attraction may
take place

It is a maxim of chymistry Sol non agit nisi solutum but this applys to all chem: operations —

The Question now is what means do the chymists employ to procure the fluidity necessary? They either use such naturally fluid then the case is called Solution, or they procure fluidity by the action of fire when it is called Fusion

There are two states of fluidity the one common fluidity the other a state of vapor, this is different from fusion & in some measure also from solution, & as this is a means of combining bodies we may mark it out as the third means of combining bodies that is in a state of Exhalation ——

Of Separation

Separation is effected either by elective attraction or the action of the fire — of w^ch^ separately —

Elective attraction is that mode of attraction which takes place when two bodies to w^ch^ a third is presented the third attracts one & not the other or more readily & strongly attracts one than the other — for altho' all bodies act on others in nature between which there are attractions yet all bodies do not attract all

Absolute elective attraction is when a body attracts one of the two but not the other or even shuns antagonizing

to unite with it

Relative electric attraction is when the 3d. body will attract either of the other two when separate but one much stronger than the other so as not to attract both together —

Thus if Nitre & Camphor be mixed with water the Nitre shews an attraction with water that is immediately dissolves therein, but between the Camphor & water there is no attraction but rather repugnancy to combine with each other the camphor floating perpetually on the top. having the least specific gravity; But if we one Pt. of Nitre with the other two then the Camph: having an attraction with it will be dissolved in it forming one homogeneous fluid in every drop of which there is a portion of Camph: & Pt. of Nitre; On the contrary Nitre shews no mutual attraction with Spirit of Wine but rather repugnancy never dissolving in it however much agitated; There are instances of absolute elect→ another instance of which is Nitrous acid applied to Gold & Silver it unites with the Silver but not with the gold.

Silver may be united with Gold or with the nitrous fluid but has the strongest attraction to the acid; this gives an instance of relative electric attraction. Spirit of

wine

wine unites more readily to water than it does with Camph
tho' it has an attraction to both thereof if we add water to spirit
of wine & Camph: the water will combine with the spirit of wine & the
Camph: will be disengaged & float on the surface

This leads into the reason of absolute elect: attraction
in order to procure a separation of bodies by chym: operations

It depends on this fact in most cases, that an elective
attraction only takes place between two bodies at once not three
or if a weaker attraction has already taken place as between
Camphor & spirit & a stronger takes place between one of them &
a third body as spirit of wine or water, then the other as the
Camphor is thrown out

So when bodies are blended by nature or art, we may
mutually separate them by chymical operation or elective
attraction tho' not exactly by any mechanical apparatus.

So gold & silver blended together may be separated by
means of Aq: fortis & aqua Regia the first having a strong
attraction to silver, the latter to gold —

Sir Isaac Newton first formed the table under
throw and but extended it no further. Stahl also took it
in consideration but Geoffroy was the first who made a
table of affinities comprehending not only the affinity to
each other but to many others

The nitrous acid will attract all the substances in the column under it in proportion to the order in which they stand thus it has a stronger attraction to Iron than to Copper & a stronger attraction to Copper than to Silver —

Here we are to remember that it can join only with one at a time — Hence if it is united to any one by applying a 3d. it stands above it & the other standing below it will be thrown out & that in between them and & this stronger take place — eg. Take a solution of Silver in the nitrous acid diluted with water; put into it a piece of Copper & the Silver will be precipitated in proportion as the Copper is dissolved — & instead of a transparent fluid as the solution of Silver is we have again one

This will serve as an illustration of our table of nitrous acid —

In the next place having separated the Silver it may be a problem of consideration to procure a separation of the Copper. but by looking in the table of elective attraction we find Iron stands above Copper. therefore by immersing a piece of Iron in the solution the copper will be precipitated to the bottom & the iron take its place in union with the nitrous acid

In the same manner may easily be gained a general idea of all the different tables of affinities

We can not only by this means separate one body from another but also the constituent parts of a body may be separated or decomposed e.g. The constituent parts of Sal ammoniac may be separated by means of certain media

If we want the said separate separate we must find out some attraction the alkali stronger than its present and which is the muriatic & by looking into W.ms Geoffroy's table we find fixed alk: has the vitriolic & nitrous and have equal attraction that is than the muriatic Therefore the P. W.ms will procure a separation of the muriatic and from the Sal ammoniac

But suppose we want to separate the volat: alkali of the sand sal ammoniac then we must use a substance having stronger attraction to the muriatic than the volat: alkali has W.ms upon looking into the table we find fixed alk: has. Therefore dispose the Sal ammoniac in water & put to it the fixed alkali &c. will unite with the muriatic and detach the vol: alkali which rises in fumes & may be collected separately by a proper apparatus

But it ought to be observed that by operating with this attraction we dont procure a separation without also

also producing a new combination not separating the parts by themselves —

We can indeed employ elective attraction to get one part separate, but this is effected not by single but by double elective attraction —

All the examples we have yet given of single elective attraction which is when a single body is employed with a mixt body in order to decompose it.

But double elective attraction is when we employ one mixt body in order to decompose another & in which both the parts of the mixt operate: as if we use copper dissolved in the nitrous acid in order to decompose silver dissolved in the nitrous acid for here there is a double attraction, a double separation & a double combination that is the one mixt body in order to decompose another mixt body & yet only one part of the mixt body we use to decompose the other works the effect this is only single elective attraction as there happens but single separation & single combination —

In our cases of double elective attraction we always begin by that part the substance from which the part of the last proceeds is more strongly attracted by the substance which

the

the point is towards, than it is by the substance it is at
found combined with

The 4 first diagrams comprehend all cases of
the double elective attractions that we yet know of. & indeed
if practised in the cold the three first only take place

Between the two first & the third case there is this
remarkable difference that in the two first we can procure
a decomposition of either mixture by applying one substance
only so that this position of parts does not oppose any
advantage from a double elective attraction the case
being got by single elect. attraction — but in the 3d
case we cant decompose the fixed alkali united with
the ⏚ by either of the substances of pruss alone, but
only by both together & this is one of the most important
to be attended to as a double elective attraction is
always necessary here a single one being insufficient

Case 4th This position of parts does not take
place in the cold by mere solution but we apply
heat in order to volatilize sepparate one body
that generally if not universally this case can
be converted to case the Third —

It is proper to know whether in any case a double elect: attraction can be employ'd —

If the question is whether I can employ mercury united with the muriatic acid in order to procure a separation of the nitrous acid from Silver

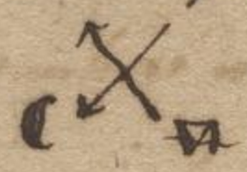
I look into Geoffroy's table under muriatic Acid in consequence of wch I find the dark lines ☿ ☾ ☿ ☾

The rule for placing the tail of the dart is always to that substance which we want to compare w: the 2 others

I want now to compare the force of the ☿ to two others — in Geoffroy's table under ☿ there is no comparison of the relative powers of ☿ & of ☾ therefore make my enquiry under fixed alk: & from that make my dark proceed — also from Silver under column of M.S: for the same reason ☿ ☿ ☿ ☾

Whenever the darts are placed this way or as in case the 1st or 3d a double elect: attraction will take place but in case the 4th a double attraction will not take place in the cold: for should we suppose in the 4th case for a moment that an attraction between ☿ & Silver & between

and ☉ this is convertible to case the 8.ᵒ would stand thus ☉ ☉



All the powers we have mentioned changing the properties of bodies are reducible to fluidity and the action of the fire —

If to apply a quater heat to any body than that of the external atmosphere it expands & encreases in bulk in proportion to the heat: if quater cold is again applyd then is a condensation where we see that fire has a power of separating those parts of bodies to a greater distance — so by heat we can separate the solid parts of bodies by loosening their attraction & can increase it so far as at length to produce a repellency: hence the action of the fire is repellent & hence there are few cases in nature where we see attraction which is not to be opposed to heat or fire

There may be a state in which the parts of bodies cant approach nearer each other than they are at that is not in any state of cold, we know of — therefore we say the parts of bodies are never in the greatest proximity they are capable of by nature

The fire is a repellant power continually forcing

* It is useful known in Case terms under the Name of Sir Isaac Newton, terms that are Principles in nature, are endowed with an attractive & repellent power inherent in them -

x According to the Newtonian Philosophy all the operations of nature & are depend on attractive and repulsive

bring the parts of bodies from each other; it pares
thro' them without any other change than what
have mentioned, therefore we can properly say that
it mixes with bodies but only invades them & pases
through all their pores ++ hence all the combination
separation of bodies depend on attraction repulsion &
Some philosophers not content with this, air
at greater simplicity & say attraction is the same
proper to all. as repulsion only diff. in degree
If an agreeable postulatum which is that
inert matter has this effect in certain contiguity
of destroying or diminishing the mobility & action
of the repellant powers still subsisting between the
inert particles it may be allowed that
repulsion may produce all the attractions we see in
nature. Thus we may suppose two bodies separate
surrounded with a repellent ather, they recede from
each other; but in a certain point of contiguity they
diminish the repulsion between them until the repellent
powers behind force them to unite together with the
appearance of an attraction

If any power is applyd to retard the mobility of the repelling powers interpos'd between its particles, these will fly asunder from one another till one of the others of their intervales.

Thus operates in this manner; heat diminishes their bodies, this coherent retains the activity of the repellent powers then gains fluidity & increases the distance between the internal & external repellent power: by acting further it changes into a repellent fluid as vapor / separating its particles to the greatest distance

This doctrine you may find upon Sir Isaac Newton's works but more particularly in Dr. Bryan Robinson's Dissertation on the Ether of Sir Isaac Newton.

This is the only principle that will furnish us with a rational theory of elasticity: from this we understand the cause of the solidity fluidity and rarefaction of bodies; from hence we learn that the qualities of bodies are qualities of aggregates and depend on the different mode of combination.

If there are any qualities of matter that are only so far as they may be resolved & capable of former

other

ther combination, or, in the progressive change of
one body to another —

The principal difficulty which occurs in the
transposition of bodies or elective attraction:
how one body has an elective attraction to other,
when we would imagine that their other would
equally pervade the bodies —

On the medical virtues

of

Oils sulphur and

spirituous liquors, as

Wines & Ales

Also

Critical Remarks on the Saline

Preparations of the London &

Edinburgh Pharmacopeias

Together with

Their Medical Virtues

Likewise

of Alcohol & Fermentation,

&

The Nitrous Acid and other

Chemical Tracts

1st Expressed Oils — Of Oils — in med: virtues.

No perceptible difference between

chymical oils of Animal & vegetables & diff.t vegetables

We shall always lay in d.e Oils virtues externally applyd

this being understood may help us to understand their internal effects

Oils are emollient Laxative, taking off the dryness & rigidity

of the animd. fibres as far as they reach

Oils now more remarkably employd formerly than at present

in the discovery of Consumption as some imagine they detect it

but this opinion is not well founded, perspiration is scarce ever so

much as in case of the body d.o considerable some if not may judge

from it sufficient to overcome the obstruction of fecal but this

only theory; however we see from fact this does

not take place. Tenuity being common in hot countries

and people keep their bodys constantly covd & warm & use in

diet heating — constitutions much hid by patients & at least

by the Hottentots, nor is there room for the objection that perhaps

perspiration moderated thereat vinuity and sugarity in all

climates in the winter season

A variety of inflamatory affections are by the country

people treated w.th exp.d Oils without any bad effects may from the

effect it cause rather to increase perspiration.

thus in a Corpse rubbing distilled on the outside of the Nose gives
surprizing relief. In an Epidemical the country people have often
had sensible relief from rubbing it externally on the pained
D. Stork has used it with success often in bringing on a flow-
ing in Dropsies —

As to its internal use, the first thing that strikes us to
consider it as an Aliment — we can easily conceive
unchanged invasion part of the body, whereas some think
it is not changed when taken into the Aliment but
separated as an oil & not nutritious, others think it
united with the Aliment into Blood & Juices — the analogies
considered as oily in equal measure & also nutritious, & as
there is such a quantity of oil in our aliment I have no doubt
to admit it as a nutritious part thereof — Experiments on Brutes as
Animals as well as Human fully confirm it.

Oil used likewise to sheath acrimony in various diseases
in different parts of the system. The first instance occurs
in the stomach to sheath the acrimony of various humors
there, but I would not advise to trust to this in mineral
poisons with an entire Destruction by the use of Alkalis

they have often been useful in the cure of Diarrhoea and
Dysentery. — They are supposed to work further in the
system, to guard the urinary passages &c. the function of
Calculi; but I think more ingenious matters as being
more amicable will stand a better chance to reach them
remote parts & produce the desired effects.

In discharge of the Memoir attended with pain owing
to the acrimony of the matter discharged as is evident from
the parts being excoriated Spina bifida is produced but it
is doubted whether it ever reaches so far

when and matter in the latus y.e Intestinis by throwing in
oily Glysters from their smoothness they guard the parts if they
do not correct the acrimony — take off the tenuness.

Further it is supposed the bland oils have an effect
in correcting the mucus or a balsamic bitter fetid mucid disorder
but it's ambiguous whether it's owing to it quieting the fauces
& taking off the irritation or whether by entering into the blood
& being separated by the mucus glands — I always prefer the
mucilaginous Gums on this occasion tho' some boast much
of the good effects of oils above any they clyd in this case
especially our southern climates, as this occasion it is also
less proper to read Dr. Dehaen —

It is difficult for me to conceive that air in any disease could prove any efficacious medicine. I doubt whether given in considerable quantities it could reach the lungs —

2d Essential Oils — It has been a prevailing opinion that these contain the virtues of the Plants from whence they are taken, but as the virtues of plants are never lodged in any one part of the plant neither is essential oil of the leaves of Sage Rosemary or Origanum can contain the whole of its virtues — the oil of Chamomile flowers has little of the bitter of the plant which is in the extract vegetable, the oil Cinnamon has little astringency & the oil Myrrh is weaker than the substance it is drawn from, therefore we must consider all the virtues of essential oils — In general they are acrid stimulating & their stimulus is of the inflamatory kind they are also antispasmodic, their virtues they have in common but variously combined, some are more remarkable for their stimulating & have less of the sedative quality & contra they may have a greater sedative quality & be less stimulating the antispasmodic quality is something of these stimulating sedative combined in a manner difficult to be explained

I shall to explain the virtues of essential oils more particularly
I shall speak of them under particular classes as they
possess peculiar virtues

1st The Aromatics of the first Tone a distinguishing
by their specific Gravity they greater than that of water
as Oil Cinnamon, N. M. Pimento Pepper, Cloves,
These are antispasmodic powerful in obviating
pains of the stomach arising from eating vegetable substances
that contain lots of the Aroma & carminary than the antient
substances

2.d Essential Oils taken from Semibiflorous Plants
as Dill, Fennel, Anise, Carui, Coriand, Cummin are
common to Europe, do not indeed yet Turk
we have essential oils from all these in
the shops, they are milder in point of carminary yet
equally powerful as Carminatives & Antispasmodics, people
who are fond of spinal causes think it is owing to this
that people born in hot Climates can better bear the
heating effect of the Spirit. Oils of Cinnam. than those
born in Europe not being able to bear them as well as natives
as provided them in their own climate &. Antispasmodics of this
kind heating -
They are Oils inflamatory & must proper for relief to Cholera
who often require such a remedy

Both these Classes are very similar in their virtues to
each other

3 Another class is from the Planta Verticilata
not of the aromatick oil is from the Cup a flower
& these as in the others the virtues much in common
appl in odon, tho' many consider y.e al: Pungg: as natural
& Again, Marjoram, Lavend & Rosmary as Cephalick
& the Mint Peppermint as Stomachic tho' this
their effects seem to depend on their big carminatives, they
have each of the Stimulating & most of the sedative
virtues —

4 Another is the Cyperoides — a compound
flowers w.h afford an Aroma w.h gives an aromatick oil
& its sedative & antispasmodic virtues not unmarkable
but they are very stimulating & inflamatory

5 Another Class is from the Coniferous or resinous
as Pinus &c. are very inflamatory abounding large Cells
& ducts filled with an aromatick Balsam and
Turpentine — as to the Volatile oil of Juniper & Sabine
& actually this affords the Wood seems to be very to
& having an aud valed in them such as the said in the
Bayberry. as to Sabovals, some medicinal have

...ows of respiratory ammus in the Breast to prohibit
...ay have some pectoral virtues but not so remarkable as
...often asserted
Some ascribe that acid taken from fixed Plants
...Raw & Horseradish an way and
Camphor is a substance which applied to the Region
...ried but not to the stomach nor yet to the skin being
...se here as one of the most powerful Antispasmodics. It
...ed much in violent gouty & rheumatic Inflamations
...es in internal as well as considerable sedative & Antispasmodic
...qualities, in Epilepsies &c;
If the antispasmodic qualities dont always answer expectation
...ans that are found out in the Dose M. Potow has
...en it in hypochondriacal Fevers in large doses with good effect
...t more can it extinguish the vital Powers too much thereby
...d has its limits & the practice to be followed with caution
I have seen it given 3ss in above without sensibly
...ring the pulse, however Hoffman observes it given
...ove the above just such stops to the action of the Heart
...t there was fear it would end in death, all this is certainly
...of the sedative & Antispasmodic qualities of Camph:
The oil of Pepper mint seems to approach nearest to
...t of camphor of any of the vegetable oils

× Sulph: is got by dissipation more or less pure, Sublimat
is the best method of obtaining it pure & by that we
we also get it in a more convenient form for exhibition
method of obtaining it has now become a branch of trade
practice is not so convenient nor cheap for a small qu

The edinb: Dispens: directs us how to obtain
Sulph: but this is less effectual & more expensive — As
is now fact: as of obtaining the same cheaper than
we two heads of under the head of Sulph: in our chemical
history of Inflammables & &c: Sulph: — Bolt: Sp

3 Empyreumatic Oil, these seem to have the Sulphur parts
moderate quality in a great degree, the stimulating influ
particularly the empyreumatic Oil of Animals purified
by repeated distillation, to have a Camph: in Epilepsies
Hysterical Cases &c.

Here we may speak of the artificial Ol: Amber
which is more remarkable for its sedative & Anti spasmodic
qualities than any inflamatory or stimulating
quality in it.

I would join to these Empyreumatic oils wch have been
considered as antihysteric wch seems to depend on their
Antispasmodic sedative qualities they are better the
more they are purified by distillation, but they are less
powerful than the Empyreumatic Oil of Veg: or Animals
made pure by repeated distillations —

Of Sulphur ×

In using Sulphur as a medicine we should always
be careful to have it fresh & kept very close for in a
moist air it always suffers something of a deliquescence
composition & separation of the Acid, hence instead of having
its proper effect it rather has a contrary effect

Sulphr is not soluble in watery fluids therefore scarcely in the
humors of the Primæ viæ. It is the most effectual remedy of any
[illegible]

yet known for Iths appeld by way of Injt. externally
Sr Lard this effect I believe is owing to Vol: Acid destroying
animalcula &c. constitute the Iths Guano when taken
for months together it has not this effect the people
prejudiced in supposing the Iths owing to a scurvish
blood I believe ith want of acting this way is owing
to inolubility in prima via in any great degree being
so much as to prove Cathartic. It has this advantage
over other purgatives that ~~Lith~~ we can better meas
ure Cathartic quality without any respect to milder or less
Cauelty. It has been imagined however to be heating
from a fancy that all Phlogiston or every body y is inflam
mat have the power of exciting heat but I have found
given in Injt adon every day for a long time it never has
that effect. The only Inconvenient is that in some
it has a griping quality perhaps from decomposition
the Primæ viæ or from excessive y is decomposed by
Exhibition..

Besides this property I could never perceive it have
any effect in the blood. Ths called a putrone I must bring
forward to

Medical virtues of Wine

We can now to speak of the med: virtues of the 3d. head of inflammables viz. Spirituous or vinous liquors in gen: & this is the basis; & what we say of Spt. or Alcohol is principal ingredient of Spt. or Alcohol is principal ingredient

Wine holds so principal a place both in Diet and Medicine as demands the Physicians attention

Perhaps physicians have rather judged of wines from popular prejudices than principles - which is only to be understood from the doctrine of fermentation already delivered.

It is not my design to enter into the virtues of particular wines - As we very variable in their nature we must understand the nature of wines in gen: before we can understand any thing of particular wines.

Our wines consist of three several Ingredients Must, Alcohol, & Vinegar

Must is the unfermented juice - when it has undergone the proper fermentation it becomes strictly so called & produces the alcohol & this by farther fermenting or becomes vinegar

Must is a diluted Sugar & as much is wanting as we could say à priore it must as it contain Sugar in greater or less quantity as the finest sugar is when applyd. to the Afterliquor

Sugar & must an fermentable flatulent & produces
gas explosive which may stimulate the moving
fibres — the must is capable of the vinous fermen-
tation in the intestines humies on glued to the sides,
sugar is evaporated. & precipitating the bile or mixing
with it proves an acrid purgative & has a
property of drawing more bile into the primæ viæ
perhaps by thining it & thus produces not only a
Dianhoea but Cholera Morbi.

All our reactions seem connected with
final causes, being all repeated in greater quantity
as more demanded wch is noticed by a stimulus; the
must then stimulating demand a flow of bile to assist
the acid & accordingly obtain it wch may bring on
Dianhoea, or by its irritation, Nausea, Vomiting
& cholina morbus

Next ingredient in the wine which may be called,
we can only protein its principal ingredient Alcohol
wch is a stimulant to the part applyd: in the stomach
it has the effects of an antispasmodic & carminative,
it is likewise stimulating & inflamonating to the whole
system but in a certain dose proves Narcotic. Thus

n Opium, if any way different it is in being inflam
mable. Then effects may be separated. If Opium
itself from me can take a large quantity of Opium
from the same & take only a small dose it will
from an inflamy: stimulus, increasing the fever, in
large dose it proves narcotic; such as the analogous
effects of alcohol, in a small dose it is antispasmodic
in large it weakens the nervous power, & in
certain degree extinguishes them & brings on Delirium
Death & from custom a large quantity will have
little effect. The same may be said of Alcohol.

Alcohol shows the different effects coagulating
the animal juices & hardening the solids, according
to these qualities they may be greatly diversified for
in proportion as it is diluted they disappear so that
diluted Brandy has little coagulating power in
whatever quantity — If could it be done from
rubbed into the Stomach it would only produce the
coagulating effect on the Stomach & parts it touches as
necessarily requires to be so much diluted before
it can enter the blood as not to be able from coagulating
to produce Scirrhi or cancerous Ulcers — but this is
owing to its narcotic quality as is proved from the

experiments in some rendering it proper for a long [illegible] on the

~~The functions of Bodies are~~

Turks who debauch with Opium & have the same complaint of vesicles Liver viscera from the use of Opium as those who indulge in an excessive use of Alcohol — Its action must therefore be on the whole System & not on the particular fibres of the viscera

Besides the alcohol there is always a quantity of water and oil, these are blended together in wine by the action of fermentation. they are in diff.t proportions in diff.t wines — the water every one can see is very diff.t — those wines w.h are liable to form tartar have the acid increased, & the wines have the oily matter predominant, these modify the intoxicating part of the wine as any one may take a quant.y of alcohol in wine than serve, hence wine as a cordial is of greater value than either opium or alcohol we can easily subdivide the dose so as not to be agreat stimulant or narcotic owing to the peculiar mixtures made by Fermentation.

This mixture we endeavour to immitate in Punch but the inflammatory effects of the alcohol are nevertheless by such mixtures, & it can not come up to the virtues of wine tho' the alcohol is not in so large a proportion it will be more inflammatory. The acid of lemon is an useful & innocent ingredient in wine rendering it proper for a detergent in the

mouth & fauces, pleasant to the palate & stomach allays
thirst, & promotes appetite, when it becomes quite acetous it
counteracts altogether the action of the alcohol.

This seems similar to the method of sulcifying alcohol
by the addition of acids.

When the acid is fully formed the alcohol is destroyed —
even counteracts it in small doses. — Boerhaave took
notice that crude vinegar thrown into the still would give over
alcohol, but when the acetous is once perfectly formed no
alcohol can then be obtained by Distillation

This acid to be considered very differently from the acid
first evolved by in fermentation, as the first acid is joined with
sugar sylvestre but this acid or vinegar not

If crude indeed it may retain some mucil, yet it is
still capable of that fermentation producing gas sylvestre, but
the acid will be remiss if to hurry or faster to the acetous
fermentation

an add juice joined to a sweet is the most dangerous
producing Diarrhoea, Cholera &c: more so than unripe
ripe fruits where more than a perfectly formed acid vinegar
both this last produces its effects by weakening the tone of the
stomach & Intestines & is injurious in arthritic & asthmatic cases

These are the three ingredients in wine & according

…thus prevail the wines and diff.ts such now of them are
…ll perfect in their wine. Thus are to be considered as intoxicat:
…ts in the whole process only.

The alcohol prevents the fermentation of the unfermt.
…rticles of must, & also the weakening cooling effects of
…utum whilst the must & autum heat the stimulating
…flammatory effect of the alcohol.

Wines are divided and to their degree of fermentation, as
…ew crude, mellow, or approaching to decay.

The crude wines are liable to create a gas Sylvestre, to
…duce flatulencies, Spasms & cholera if the dose is considerable
The ripe & mellow wines are useful to the prima viæ but in
…great quantities they intoxicate, bring on stupor Delirium
…n death

The decaying wines in the Stomach by their too cooling
…lect may become hurtful, but not so much as the crude
…nes

Wines are distinguished by their sensible qualities.
1st. As sweet or sharp. The sweet wines owing to
…veral causes, as checking the fermentation, adding sweet juice
…ich &c: these to be looked upon as crude. Sweetness may
…so arise from a richness of the grape & cultivation w.h is
…compatable at the same w.h the larger proportion of alcohol
…the Tokay wine.

Those wine w.h have most acidity are always weaker or have
…le body. Another particular w.h regard to sharp wines is according to

the degree of acid, they are more liable to an advancement.
Lastly the thick wines to be considered as more crude. In them
we must take care to keep the fermentn going on slowly & for a
much numbered years together thence a more perfect body and
ferment as is kept up in the Heidelb: Ton by new additions.
Then thin wines rush on with greater impetuosity to the
vinous state & produce something approaching to Tartar in a
greater proportion & produce effects as impute to that
2dly Another difference in the sensible qualities of wine
thin strength & weakness — The stronger the wine the
more inflammatory & approaching to alcohol.
The weaker wines having more moisture are more apt
to produce fermentn in the stomach turning on to the acetous
fermentation & become acescent.
The rich wines have always some fermentn going on
3dly The last quality to be noticed is the smoothness & rough
wines. The more mellow smooth from aqueous quantity of
the matter more nutritious & most subject to fermentation
Lastly — wines are rougher in proportion to the quant: quant.
of Tartar they contain or from the acerbity introduced from the husk
with being more exact the nearer the centre & ascerb towd. the rind
husk, when these husks are ripe they are roughness to the
wine.
The sweet smooth wines are laxative, the rougher acerb
universally astringent — The red color of wines naturally

lands on the Rhine. & is a mark of extravagancy – but in
this we are often misled by the wine merchants colouring
them artificially

Wines of the northern climates are generally innocent
in their weaker state, such is the case produced in this
country – wines of the south: clim: are rich cold strong
& nutritive as those of Tokay they are safer for the stomach
but pass more slowly thro' the vas: secretions. hence less
diuretic – The wines of Italy are most from an
imperfect fermentn: therefore not strong – The Spanish
wines are commonly rich & will not bear to be transported
or without a condim: or brandy admixt with them
whence they acquire equator strength – under these I
include the Portugal wines.

The French wines are of a middle character &
strength, they are more perfect, but contr: agreeably
& must submit to acquire their fermentn: unless dashed
with Brandy; they are rich & pregnant with nutritious
& I think the fermentation is not carry'd to a due
degree of maturity – Those wines transported in Bottles
will be so perfect as those transported in Casks for unless
they are tolerably ripe when in large quantity they would

apt to incres this fermentation.

Stake the burgundy wine to be the most
perfect in Europe from the good soil, conduct of fermentation,
proper pain, &c: & is more perf: than that of Champaigne

The Champaigne is a weaker wine, more ready, has
more wateri ferment: & now
is newer to a greater degree sylleuro is produced affecting

The Effects of a more Southern produce &
have neither so much liveliness or intoxicating effects
but the maritime situation makes it a neat wine, it
is weaker than the other wines — a great deal of care
is taken to give it a due perfection both in growth and
fermentation — it is transported in Hogsheads & is I believe
the most perfect wine we have who is sufficient
in purity & strength & is not so hurtful as is imagined
in hypochondriacal cases.

Madeira wine is the one least apt to ferment in our
stomach but is sometimes of such an odd mixture as to
have that property.

This is enough of wines as connected w: Alcohol
let us speak a little of Ales —

Of Ales.

Malt liquors are to be judg'd of from the same principles as those of wines before mentioned — but the fermentation is not so easily conducted — I believe it never undergoes so perfect a fermentation & therefore more crude parts not assimilated: & whence one will allow we are obliged to use a condiment or it soon runs into the acetous fermentation, it is therefore more dangerous mostly than wines & less agreeable to the Stomach.

The Tartar of Malt is a more acid Liquor than the juice of the grape & perhaps on that account not so capable of a perfect fermentation. Every one is sensible of the Stomach being more loaded & sick after drinking much ale than after drinking wine

I have now finish'd the medical properties of Wines & with them the consideration of the inflammables next we will proceed to the consider.: of saline Substances &c

Saline preparations

As many saline preparations are immediately applicable to practice it will not be amiss to make some observations on the preparations of them in the Dispensatory antecedent to an account of their medical virtues.

The first is Essent: Salts

2d is Sal Absynth: This is not to be look'd upon as anything inferior to the other fixt alk: Salts but only as a model or example. The difficulty of collecting such kinds as afford the fixt alk: more abundantly obliges us to have recourse to the more solid woods for obtaining it by burning them to ashes &c:

Their directions unnecessary as the pearl ashes brought from Germany is a branch of Trade hence can be afforded at a small expence & is as good as the Apothecary can get with all his labour, It would be better to direct him to purify the German Pearl ashes already purer than he can make his by the prescr. directions of the Dispensatory.

It is a matter that would highly ascertain what degree of causticity or mildness is to be sought in our fixt alkali, or in what degree we should choose them caustic or mild.

The London Dispensatory directs the alkali to be kept

in the fire for several hours — if a caustic alkali is
wanted the directions are proper, but I believe the college
did not that in view, & it can be obtained in so much
more simple way by acquiring it of air by Quicklime as
is much preferable

If the german pearl ashes require any operation it
is only one Solution in cold water to work off any
adhering tartar adhering filter & evaporate to crystalization

The Edinburgh Dispensatory must direct the manage-
ment of tartar & cream of Tartar what in both the cases.

The Lond.n Dispensatory have put the crystl. Tart.
in properly in the list of simples as the obtaining of this
is only practised with accuracy in Languedoc & some few other
places in France.

A memoir on this subject has lately been published
by a french physician who resided there. But as they
do not occur in small quantities are to be regarded from the
Dispensatory.

Both the Lond.n & Edinburgh dispens.ries have directed to
purify this Tartar in order to obtain the Salt of Tartar

Salt of Tartar is no way different from any other fixt
alk: in an equal degree of purity; had the colleges understood
what the ambiguity & causticity of alk: Salts depend

ey would not have directed it: 'Tis true as the collage
said it is a little milder than the fixed alcalies but they
may easily be brought to the same degree of mildness.
Then is more oil & salt of Tartar than in the salt from
ashes of vegetables, but the oil not determined to be of any
use.

The 2 colleges have directed the Tartar to be
calcined with a great heat in order to obtain a very
great whiteness but this is unnecessary. It is enough
for the Apothecary to throw the Tartar in powder into a
Crucible made red hot & to remain there about half an
hour then to be lixiviated & evaporated to dryness as
white a salt will be obtained without the loss of some
of the salt: which I think must happen in long calcination

The colleges have mistook the proper measures
for obtaining a caust: alkali, as it is a much easier
method to procure it in that state by means of quicklime.
They are also mistaken in giving the greenish or blue
color as a mark of its being good &: arises only from
any phlogiston falling into it, or Sulphur before it is
quite finished.

The next preparation is the oleum Tart: per
deliquium of the D: Dispensatory now properly named
[illegible] the vitriolic acid must be much

on the Liquiors. Tartar of the Lond.n Dispensatory
signifies liquiating by water
If we want a neg.t alk: in a mild state shall already
two directions how to obtain it by adding of vol: alkali
forming it to a deliquescence in the air or as to
crystalline which is making it perfectly mild more
than effusions of water. The Ld: Dispensy has
ered it to be made very caustic as if it would sooner
per deliquescium by this means, but the college
being sensible of the intention they seem to think
has an advantage in making the neutral salts
ich follow, this shews ignorance of chemistry, as
mild or caustic alk: be the same in making any
utral Salts, for a mild alkali has its aer adhering
ith union with the acid whilst the caustic has
eady lost its air

Tartar vitriol. they direct how the vitr: acid
of Tartar per deliquescium but it makes no difference
w the first alk: is dissolved whether by Deliquescence or
water — there is no particular purpose answered in
luting of the oil of vitriol if you use a solution of Salt
Tartar in water but if the Salt of Tartar is not
solved in water the vitriolic acid must be much

dulated, for in dissolving Tartar in the vitriolic acid equal
at arises so as to endanger the breaking of the vessel
fore must be diluted. The London college has judg'd proper
order hot water for the vitriole to be dissolved in, but
much great heat is generated in the mixing of this
th the Salt of Tartar it would be better to dilute
is inconvenience by dissolving the vitriol in cold water.
The Edinb: college has judg'd ill in directing the alkali
be applyd to the vitriolic acid, but the London has
better directed to add the alk: to a mixt as given vitriol
dissolved in water as it is otherwise difficult to hit
the point of Saturation.

The L: college here seems to have directed superfluous
quantity of alk: in this neutral Salt & in another Neutral Salt
superfluous quantity of acid, that is in one the chosen
the alk: should be predominant, in the other the acid
hich will be mentioned when we come to that Salt.

The Unition of the Lond: Dispensatory gives the only proper
vitriolated Tartar; tho' they dont exactly point out
ow much alk: will Saturate yet they dont err
uting $\frac{3}{ij}$ or $\frac{3}{iij}$ amplius —

Nitrous vitriolatum of the Lond: Dispensatory
early the same as the vitriolated Tartar only some

ent of the nitr: remains undecompounded after having
d the Sp. Nitr: Glaub: & this more or less according to
e different accuracy or inexactness in performing the operat:
d must subject this preparation to a variableness and
ertainty therefore is not scientific; This intention I
ieve was influenced by knowing that if they only directed
e nitrous: the apothecaries would not take the trouble
f making it but substitute this nitrous vitriol: or residue
after distilling Glauber's Spirit of Nitre in its place, but
d the college whose seem to countenance the use of the
itr: vitriol: being in all cases substituted for the Tartar
itriolat; they have ordered both without seeming to take
otice that the preparations are the same

Tartar: Solubile of the Lond: Dispensatory—

e crystals of Tart: an ord: to be dissolved in twice their weight
f water, & the oil of tartar p deliquium to be thrown
nto the effervescence ceases.

In the Lond: Dispensatory we have the same med:
ber made but in point of convenency very differ:
by the directions of the Edinb: Dispens: we have from
the quantity of water much about the proportion & so
much the greater quantity of water to be evaporated.

the directions & conveniencies of the Lond.: Dispensat.:
in preparing it is much greater & more facile, otherwise
the composition is the same.

This has been much used in France & transmitted
to us under the name of polychrest of Rochelle.

Both colleges a little faulty in their aforedirections
for the Lond.: directs to filter when hot, the London is
silent, but certainly the cont.: of the Lond.: is to be followed
for the crystallization would give the purest salt, but
this salt is not easily crystallized, the evaporation must
be or slow to gain fine crystals, therefore the direction
of carrying most likely to be followed

Any superfluous quantity of water can only make
it a more grateful medium

A medium much in use in France under the title of
Sel de Seignette or Rochelle with only the difference of
which salt: it crystallizes better this not so frequent as to
the medical virtues authors are all hupers.

Tartar. vegetat.: is the next in the Lond.: Dispensat.: &
the same as in the Lond.: dispens.: is called Sal Diureticus
but this last name is improper as it may mislead the
practitioner these names are given as supposed to
point at their virtues & any medicine is named to be

particularly respected of — the directions in the Edinb.
dispensat.y are imperfect & erroneous — the only proper directions
are given for the preparat.n of this Salt are in the Lond.n
dispensatory therefore that is to be followed simply according
the explanat.n of D.r Pemberton in the notes of the transl.r
of this dispensatory

The directions of giving it its utmost purity by
dissolving it in Spirit of wine are very proper.

The next observation in the Ed. Dispens.y is the
Sal Septic or cauterium potentiale. I think the
strongest caustic always to be suspended on that plan the
directions of the Ed. Dispensatory are improper. The
Caustic and common potash of the London dispens.y
preferable

Of the Medical Virtues of Salts

Of Alcohol & fermentation

It is the common opinion of chemists that alcohol only the product of vinous fermentation, how properly s will not determine, but if lead be dissolved in vinegar vegetable acid & subjected to distillation a product is ilen out in every respect resembling alcohol.

This then seems to be a proper place to treat of fermentation in general.

whenever any matter added to another, produces change in the whole mass, converting it into the nature of the ferment added, the chemists have universally called it fermentation.

Such a change happens on adding yeast to wort in making Ale. Also in the putrefactive process there a small quantity of putrid substance makes the whole mass to which it is added undergo a change of whole substance

When considerable changes are produced by adding small quantities of ferment which assimilates large ases to its own nature; or when any substance undergoes ntaneous changes & becomes so altered as to prove itself ferment to other bodies it is always called a fermentation

dant in the fossil or mineral kingdom. but vegetable
substances are the most usual subjects of it.

The saccharine juices of plants which affords
sugar it is now agreed upon are the most proper subjects
for vinous fermentation.

The substances affording this saccharine matter
whereby undergoing this vinous fermentation may be
divided into 2 classes. 1st Those subjects which in their
natural state are fitted to undergo fermentation. 2dly Those
subjects which are not fitted for they are prepared by nature
or require some changes to be wrought on them previously
by art. this operation is malting or something analogous.

The product of the first class is called wine, that
of the second is called Ale.

The requisites for fermentation in the first class
are, 1st a proper degree of fluidity, Sugar in its dry form
is not fitted to undergo fermentation. if it be only diluted
so far as to take the form of syrup it will ferment so
that the least quantity of water to that of sugar that is requisite
in order to procure fermentation is as 1/3 of water to 2/3 of
sugar & as much more diluted as we please to a certain
degree. beyond wch tho' it will indeed ferment yet the

neat heat hurries it on so as to dissipate entirely the
ous Sylvestre &c. ought to be adsorbed again as it is a
neat manum constitutes the alcohol at last principle
fit.

3:ly Fermentation is entirely destroyed by lightning

4:ly The power of burning sulphur is very considerable
preventing fermentation. A Cask being plentifully supplied
with sulphureous vapor is against prevailing against
after fermentation in a cask in which wine is put. which
contains 2 oxygen so strong as to burst iron hoop casks
This 2d ferment: may however be hindered by adding to
by the fumes of sulphur which when applyd to it in great
quantity will entirely destroy the ferment

5:ly Acids, alkalis, absorbent earths, neutral Salts,
oils, ardent Spirits, & animal mucilages as the whites of
eggs, check fermentation.

Wines are liable to 2 diseases the 1: acidity
when instead of 2: moderating fermentation the liquor
grows rapid. 2: Acidity when the first fermentation
is when so violent as to hurry it on to astate of vinegar

Fermentations is generally reckond to be of 3 kinds
vinous, acetous, & putrefactive, or rather three different
ges of the same process each one producing a substance
a different kind from the others.

There are no doubt several other fermentative
nesses besides the three above; there are various in the
getable kingdom. & tho' so much pains has been taken
these 100 years past to throw out all the notions of
inions of fermentation happening in the animal
dy, yet a putrefaction fermentation in the body is evid:
had we time to enter into the subject we could easily
ow a variety of fermentation both in the animal
vegetable kingdoms

Certain diseases in the human body of which the
mall pox is one, & others in the vegetable kingdom prove
hat fermentations take place in them both.

There is often found a black rot produced in
egetables by disease which infects the vegetable in such
manner as to produce such changes as agree with
he definition we have just given of fermentation.

No body imagins that any fermentation takes

mentation will be weak & incompleat, the quality
ways depending on the quantity of Sugar according to
ch also will be the quantity of alcohol produced.

2.d Next to a proper degree of fluidity a certain exposure
the air is necessary. If the air is condensed or compressed
the surface of the liquor or if the liquor be kept
a close vessel, the fermentation will be stopped and
quasi an exposure to the air will occasion a dissipation
compatable with with the proper conduct of the ferment.n

3.d A certain degree of heat is necessary for the
per conduct of fermentation at least 6 or 7 degrees
ove 40.d in Fahrenheits thermometer. On the
her hand above 80 degrees is incompatible with the
per conduct of it: Between these degrees is the proper quantity
heat especially between 50 & 60 or last little above is
e exact heat in which the fermentation will be most
adily excited & carryed on best.

4.th Besides the application of water air & heat,
the vessel should be at rest.

The liquor committed to fermentation is commonly
ansparent & seemingly at entire rest. After some time at

vides or bottom of the vessel air bubbles are formed which
discover themselves to us collected in the body of the vessel. then
ing of its specific gravity continually rise to the top and
ase till the whole liquor appears full of them is agitated
th an apparent motion, & now the air expanding divides or
vides the rising bubbles.

The air letting both away from the bubbles leaves them
such a tenacity as to be collected in the form of froth viz:
necessary circumstance to fermentation, for if the
oth should be secured off as it rises the fermentation
ued be checked. During the fermentation if the froth
removed to one side of the vessel it sinks together so as to
close or the surface of the liquor, a necessary provision of
nature, and the fermentation is known to be finished
hen on Removing this froth it does not close again

During fermentation a substance exhales viz: ch
is called by Boerhaave the gas sylvestre & if taken
in with the breath proves highly injurious producing a
stupor & many nervous complaints.

If a caustic alkali be long exposed this gas sylvestre
it will be saturated with it & become a mild alkali know

an view that it is fixed or mephitic air.

During the fermentation matters are constantly
formed which fall to the bottom giving us the Lees & as
fast as deposited the ferment: at length ceases the trans-
parency & fluidity of the liquor is restored & rather increased.
If the substance exposed to fermentation was the juice
of grapes this liquor is called Wine

If this before had been subjected to distillation
it would have obtained an ardent substance, but in place of
it we now have an inflammable Substance which before could
not be obtained this is called Alcohol

It is not this first ferment.n that gives us the alcohol
in wine the 2d slow fermentation that follows it (wherein
wine having age) has a greater effect in producing the alcohol
than the first more active one.

means of checking fermentation

1st It is to be shewed that neither a vacuum nor
compressed air will allow of an active fermentation.

2.y Cold is injurious as it may either check or
entirely destroy fermentation

It would be improper to mention heat as a means of
making a destroying fermentation tho' in a certain degree
as it is impossible to conduct it properly because the

An Essay

Ant thu

Nitrous Acid

Containing

1st The natural History of the Nitrous Acid

2d Chemical History of Nitre

3d Different methods of extracting the Nitrous Acid from Nitre

4th The chemical properties of the Nitrous Acide

5th Its uses & various Names

Of the nitrous acid

The acid of nitre is never found in a separate state. It is obtained from salt Petre w^ch is a composition of nitrous acid & vegetable alkali[a] & may be also procured from calcareous nitre & nitrous ammoniac, but is only obtained in general from salt petre for the purposes of art. The acid is produced by a natural process of putrefaction; but the alkali is a creation of art. We sometimes meet with efflorescences of earthy matters impregnated w^h nitrous acid, but very different from true nitre.

For the production of nitrous acid an requisite 1^st putrid or putrescible matter, either of the animal or vegetable kingdom, 2^dly certain earths as lean clays, lime stone, Gypsum, the rubbish of old buildings &c &c 3^dly Air.

The air of the earth seems to be so imbibed and retain the salts whilst the air serves as an agent or instrument of putrefaction & furnishes its own acidous acid w^h being intimately blended with the oily & nervous matter by means of which the motion of putrefaction is at length converted into nitrous acid

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[a] See Neumans Chemistry p 197. 198

All animal & vegetable substance contributes to the
nution of nitre in so far as they are susceptible of
trefaction; animal substances as being most disposed to
trefaction are for this use the most proper, & the soft &
id parts more so than the hard. Greater quantities
Salt Petre are produced from urine or dung whose
ring tendency to putrefaction renders them preferable
any other matters. Some differences are observed in
excrements of different animals, human urine, the
ine of sheep, goats & horses & the dung of pigeons are
und to answer best; the leaves, flowers, stalks of
egetables, hay & straw, saw dust &c are mixed with the
mposition & contribute more or less to the effect according
their degree of putrescibility. On these principles
the may be produced in all countries, & in many
aces very advantageous works might be established
if we were better acquainted with the mannus of its production

This Salt, however obtained is called Nitre or Salt
Petre & from this we obtain the nitrous acid.
(See Marquer vol i p 20 to 21) See him also for the
nuation of obtaining it vol i p 253 &c: copied at large in the
dy) & also what he says from 204 to 31 page before the operation
w before. Operation what factors of the this mark *

But another process for obtaining the acid of Nitre
highly dephlegmated. Take any commodious glass vessel by
means of the concentrated oil of vitriol w.ch attracts the
fixed Nitre & detaches the nitrous acid w.ch comes over
in the heat of the fire. [61] Take 3 parts of pure dry nitre
reduced into powder, put it into a tubulated retort placed
in a sand bath a large receiver must be closely luted on, & one part
of the concentrated acid of vitriol poured in, by little at a time
thro' the tube of the retort, which is to be closely stopped
after each addition. a part of the nitrous acid will arise
without the application of heat. The retort must be
placed in a reverberatory furnace; after the spontaneous
vapors have ceased the fire is to be augmented by degrees
till nothing more will come over. This spirit is extremely
strong, volatile & corrosive & requires to be well weaned from
phlegm otherwise its more active parts will soon be dissipated.
It is made after this process it is known from Glauber
invented by the name of Sp.t nitri Glauberi. what
remains behind is vitriolat: Tartari

As Salt Petre is often impure by an admixture of
common salt which is generated with & not always sufficiently
separated from the nitre [61] N: Chem: p.: 207
in vol.: 1.

The muriatic acid is also difficultly separated from the
nitrous acid, so frequently the acid of nitre is tainted with
the marine acid, & exclusive of this, when the nitrous acid
is obtained according to the best process by separating it from
the alkali by means of pure vitriolic acid, then it is generally
united by the admixture of a small portion of the vitriolic
acid, w.h having no basis of its own to sustain itself is
taken up by the last upon it can lay hold of the basis
of the nitre.

most experiments require that the acid of nitre
be absolutely pure, viz it be intended for such it must
perfectly cleansed from the vitriolic taint

We are invited in books of chemistry to purify this
nitrous acid from the taint of the vitriolic by mixing your
acid with a quantity of pure nitre & distilling it over again.
The vitriolic acid w.h is the spirit of nitre is adulterated
mixing in contact with a great quantity of undecomposed nitre,
unites with its alkaline basis & expells a proportionable
quantity of the nitrous acid.

Then is a second method by w.h we can purify
that acid both from the taint of the vitriolic & of the
marine acid. It is this. Pour a solution of Silver

the nitrous acid (or put in a little silver alone) into the
spirit nitrous acid. The ammoniated vitriolic acid will happen to
it then will lay hold of the Silver & fall to the bottom with
it in a state of corrosion.

Color of the nitrous acid

The nitrous acid appears different according to the
various processes made use of in obtaining it. When
it is obtained by distillation with bales, & clays it is
transparent as water & equally colorless. — When it is
got by the process of green vitriol it is more like of a
greenish color. When it is procured by means of the spirit
vitriolic acid in a concentrated state it has a high brown
or dark reddish color. But if instead thereof Iron is made
use of to obtain it by distillation, it is diaphanous like
water as in the first case when procured by means of
bole or clay.

This change of color seems to depend chiefly on its
degree of concentration. If to glauber's spirit of nitre
a certain quantity of water be applyd it will turn
green; or being expond to the air however it will become yellow —

when we would dissolve Silver in the nitrous acid; it will
not readily combine therewith unless the acid be somewhat
diluted with water & then a green color is always produced
which goes off wholly or in part on being exposed along
time to the air.

The nitrous acid is most brown when most concentrated
green when diluted with water.

Nitrous acid when exposed to a degree of cold equal
to 10 degrees below naught in Fahrenheit Thermometer
never freezes.

Its specific gravity when concentrated in the highest
degree it can be got is according to the accurate Mons.r
Rouelle / who took uncommon pains to concentrate it
to the utmost to water as 15 to 10.

Its properties when applyed to other bodies

1.o Salons. In combination with other acids that is
always generated. with alkali it produces the same
phenomena as mentioned of the vitriolic acid, forming
with the three alkalies so many particular Neutral Salts
viz. with Veg: alk: Common nitre, with fossil alk: cubic nitre
with volatile alkali nitrous ammoniac.

Neumann p 195

By Mr. Homberg's experiment it appears that ℥x of
concentrated nitrous acid is necessary to saturate ℥i of vegetable
alkali: & that the weight of nitre thus produced is ℥ij ℈ij.

This acid has a stronger attraction to alkalies & earths
than the muriatic & vegetable acids have to the same & can
put them from their basis of alkali or earth; but it's attraction to
those bodies is weaker than that of the vitriolic acid &: vice
versa: in like manner expel this nitrous acid from those bodies when
combined therewith.

2d: Inflammables. It unites universally with oils
causing great heat effervescence & particular odours accor-
ding to the different oils &c: with which it is made.
mixed with distilled oils it raises a great heat effervescence
forms with them a thick resinous mass like turpentine.

If the acid is highly concentrated & mixed gradually
with some of the thin expressed oils the matter bursts immed-
iately into actual flame.

This experiment does not succeed unless the acid
be highly concentrated, & even when it is, there are few
oils which it will inflame with certainty without the
assistance of a particular circumstance first discovered by a

a) Neumann p 195

by Monsr Rouelle & communicated in the French memoirs
for the year 1747

On letting fall into the oil equal its quantity
of the said the mixture effervesces, smells & alights sponsous
al arises; a little more aid found upon this coal
& it constantly on fire; by this method almost all
vitriolic oils may be fired by sft. of nitre of moderate
strength. Captured oils may also be set on fire by a mixture
of the nitrous aid with an equal quantity of the oil of
vitriol. The use of w.ch last seems to be to absorb the
aqueous humidity of the nitrous aid & thus reduce it to a
greater degree of concentration or strength than it can be
brought to by itself.

The other mineral acids raise an effervescence & heat
with oils but the nitrous is the only one that produces actual
flame with them by itself. It is certainly a curious phenomenon
& 2 bodies w.ch are cold by themselves & found upon being combined
together produce heat & actual flame.

Pulvis fulminans

Aurum fulminans is gold dissolved in Aq: reg: & precipitated
by fixt alk. If you attempt to melt this precipitate in a

x God incapacitated from doing by other by the assistance
the air will explode with a loud noise & your ears have
witnessed —

in a Crucible it will fulminate as soon as it feels the
heat with a violent explosion, & if the quantity be great
may be fatal to the operator, even by rending it with blow upon*
Sulphur: nitrous aid does not admit of any union w: Sulph:
Ardent Spirit. It unites with ardent Spirit &
produces the same phenomena but in a higher degree, as
the vitriolic aid, when united with the same ardent spirit
producing a nitrous ether of w: I shall again speak
when I treat of the production of that Spirit

Metals. It unites with more metals & dissol-
ves them than the vitriolic aid does, so as to dissolve & suspend
them. The nitrous aid dissolves or corrodes all metallic
bodies except Gold that have yet been tryed: & this also
if it is enabled to dissolve by a mixture of muriatic aid.
Gold has been called by the chemists ex nobilorum; as
this combination of the nitrous & muriatic acids is capable
of dissolving it they have called the menstruum thereof aqua
regis. It is indifferent whether the proportion of these
be as two of the nitr: acid to one of the muriatic acid, or, two

* hence I think we may account for a phenomenon I have observed
Gold dissolved in aq: reg: & alone by ether, that during the effervesc
exploded owing to the friction of the particles of the fulminans
I think not only but as I observed Gold to fly away with the ether

two parts of granulated lead to one of nit. acid this effect in
dissolving gold is the same.

Silver, Copper, Iron, Lead, Quicksilver, Bismuth
Zinc are most readily violently acted upon by the
nitrous acid than by any other acid, it dissolves Arsenic
With copper it forms a green, with Iron a reddish,
with lead a yellow, with the others colorless legiors.
with Tin & cobalt it only forms a corrosion or
dissolves them imperfectly, & it only corrodes the regulus of
antimony. with platina & nickel it has not yet been tryed.
Its action is most vehement on those metals which
apparently contain the most inflammable matter
as Zinc & Iron.
Its gen.l affinities with metals are as follows
If Silver be dissolved in this acid & mercury added to
the solution the acid will deposit the Silver & dissolve
the mercury in its place. If Lead be added to the mercurial
solution the mercury will fall & the lead will be dissolved.
The lead in its turn will be thrown down by Copper, the
copper by Iron & the Iron by Zinc. Volat. alkaline salts
precipitate the solution of metals from this acid and

fixed alkalis drive off the volatile. The nitrous acid
dilodges the marine from some of. The metals as regulus
of Antimony but the muriatic disunites the nitrous
from Mercury & Silver &c

Earths. It unites with earths, & Mons.
The Hamel asserts that when united w: absorbent Earths
& agitated to distillation it volatilizes them, but in several
trials made with them it constantly failed: perhaps
from his not having enumerated all the circumstances
that he himself observed, or that may be necessary to attend
to in the process.

Water. United with water in a fluid state
it produces heat tho' in less degree than the nitrous acid
does, but it produces a greater degree of cold than that
acid does when added to Ice

Anim.l & vegetable Substances It unites w.h
them with similar effects to those produced by the nitrous
acid but in less degree, thus it produces a black color in
them, & halts fermentation &c

Its peculiar property of inflam: & detonation when
forming a neutral Salt with the fixt alkali & in contact
of Nauman p. 196, 197

with phlogistic matter ignited has been already mentioned
this Phlogiston is the basis of Gun Powder.

The same inflam.n detonat.n & explosion happens
when this acid is applyd to metals w.h bears in which
the principles of nitre viz: acid & this combining principle resides.

Its various names.

when obtaind from nitre by Clay a bolus it has been
called Spt. of Nitre, when by acid of vitriol & Lamb. Spt. of Nitre
when by Gum vitriol it has been called by: Forbes diffring
only in conventiently if pure from other acids.

The nitrous acid is obtained from salt petre in three
different methods, 1st By mixing it with boles & clays
& subjecting it to distillation. 2dly By mixing it with
substances that manifestly contain the vitriolic acid with them
in like manner subjected to distillation, 3dly By combining
it with the vitriolic acid in a separate state & then
removing of the nitrous acid by distillation

Mangan chem: vol. 1 p. 244 says that nitrous
acid combined & its acid obtained by the interposition of
any of the vitriols, alums, gypseums, boles, clays; in short
by means of any compound in which the vitriolic acid is
found, provided it have not glass alk: for its basis.

The distillers of aqua fortis (viz: another name for
nitrous acid) who make large quantities at a time
who are the least disposed to adulterate do their business
by means of earths impregnated with y. vitriolic acid such
as clays & bricks.

From this last expression Mangan seems to
intimate that the separation of the nitrous acid in
this mixture is owing to the vitriolic acid in the bole or
clay & Neuman appears to be of the same
opinion. Nitre may be committed to distillation
by itself flows in the retort like oil & water

(d Chem: p. 205

does not gain over any Spirit. The ancient chemists
supposing the exhalation of the acid to be prevented by
the fusion of the salt mixed with it certain earthy matters
to divide or disentangle its particles & thus prevent
the fusion. To one pound of nitre they took 2 or
3 pounds or more of red Clay or Loam dissolved the
nitre in water worked up the powdered Loam earth
with the solution & formed the mixture into balls about
the size of pigeons eggs. These were dryed in a warm
oven, put into earthen retorts & distilled in a
reverberatory furnace; an acid spirit now arose but
in mostly weak & in small quantity. On elixiating
the residuum with water it was found that only a
little of the nitre had given out its acid the greatest
part being recoverable in its original form & having
suffered no resolution or separation of its principles.

The nitre thus recovered distilled with fresh
earth yields more Spirit, & the nitre when often remains
unchanged treated again in the same manner
affords more till the whole quantity of the salt is
thus resolved. The earth on the other hand which
has once been used though perfectly fitted for

ater from all remains of the alt, if mixed a secon
with nitre will never extract any more of
said, as proof says he that the expulsion of
id does not depend upon the division or
continuation of the nitre, for the earth divided
now as effectually as at first, but some vola
rticular matter in the earth which leaves in the
ist operation. The white earths as chalk,
me, calcined bones, tobacco pipe clay &c: extracte
d said form nitre even on the first term of using.
— He goes on thus. Stahl was the first that
iscovered the theory of this operation. All the earths
hich extract the acid of nitre contain vitriolic acid,
& it is on this acid that the effect wholly depends
ened without itself as containing much more of the
id is employed to far greater advantage."

Mr Pott a celebrated German chemist
cledges notwithstanding all that has been said
to the contrary, that he obtained a pure nitrous acid
by mixing three parts of a pure clay finely powdered

ft on part of fulverised nitre to decide and
discontinued the particles when present fusion; the
last of a reverberatory fire to which the retort was
sometimes being sufficient then of itself to separate
the nitrous acid from its basis & to convey it to the
receiver!! Be this as it will the practice of
distilling nitrous acid by means of coles & clays that
have smoth neglected & that of decomposing nitre
by means of Sperm wheal & thus obtaining the nitrous
acid by distillation is substituted in its place.

Metalla, vi pura vunt, vocantur corpora
liquidissima, in diverso ignis gradu fluida, calore
atmosphaera naturali solida, sub malleo in omnes
dimensiones extendi potentia, opacissima. Horum
numerantur sex: Aurum, ☉, Argentum, Cuprum,
Plumbum, Stannum, & Ferrum.

Aurum, Sol, cujus character (☉) metallorum
notas characteristicas quam perfectissime habet.
Omittit in aqua pura, destillata, suspensum intra ½ h
20 vui ponderis; in summo igne, quantumvis diu,
fusum substantiæ suæ nihil perdit, adeoque fixis-
simum; malleo facillime cedens; percussum non
tinnit; in igne statim ac candescit, fundituv, exhibet
que tum colorem Phalassici superficiem; ab aqua fortis
non attingitur; colore fulvo se distinguit.

Argentum, Luna, (☽) in aqua ℍ vel ½ h ½ vui
ponderis perdit; in igne aque fixum est ac aurum eodem
que fere igne fluit; post aurum omnium maxime
malleabile; facillime flexile; aquam regiam perfectam
respuit; colorem splendidi albi, purissimi.

Cuprum, Venus (♀), in fundere in eadem aqua
mittit intra ½8 ½: in igne non fusibilissimum, sed vix
multum specii exhalationum viscosarum perdit; malle-
abile quidem est, sonoribus tamen longe minus: max-
imi sonorum; coloris intense flavi: magnum ignem
ad vim fusionem requirit. & mox ac candescere incipit,
tingit ignem elegantissimo colore ex caeruleo viridi;
& omnibus salibus, & iis quae talia continent, applic-
atis, accenditur; maximam colorum varietatem;
imprimis pulcherrime. viridem vel caeruleum, ostentans

Plumbum, Saturnus (♄), levius fit in aqua
suspensum ½11 ad ½11½: liquescit, longe ante quam
rubescat; non est fusum sed validiore igni vi ingestu
specie fumi multam fundit & pro diverso igni gradu
vel fuliginem, vel vitrescentem, in vertices, Lithar-
gyrium dictam, coloris flavi totum vertitur, tenuiss-
imum; metallorum omnium mollissimum; malleo
percussum vix sonorum; coloris ex albo coerulescentis

Stannum Jupiter (♃) omnium metallorum est
levissimum: levius fit in aqua ½7 vel ponderis; non fusum
est: sed leni igne, longe ante ignitionem fusum, specie
fumi, satis cito partim avolat, partim in calcem

patiscit; antecedentibus minus malleabile est; non
tamen valde durum; vi flectitur, vtidel; colore
aemulatur Argentum.

Ostrum, Mars (♂) amittit in aqua vsi
ponderis circa 1/74 & 1/80; valde fusum est in igne;
acquirit summum ignis gradum ad vsi fusionem;
tumque de substancia sua quam plurimum emittit,
scintillat, in vitram fusco-coeruleum, & in fumos
subtiles humeos resolvitur; omnium est vsu difficillimum;
attamen nisi candescens subito extinctum sit, satis
malleabile; coloris aquei; trahitur a magnete.

Stisce ces metallis ab omnibus fere
adnumeratur ut septimum, Argentum vivum;
quanquam non habeat alias, praeter gravitatem,
metallicas dotes. Argentum vivum ☿ Mercurius
ponderis vsi 1/14 in aqua privatum; vi fumum est
semper, in summo frigore, fluit; ergo nec malleabile;
argentei splendoris; opacissimum; igne mediocri
in fumos revolutum, totum evanescit, pauciss̄imis
forte granulis, rubiundis, sabuli instar, relictis; colluti
tamen vapores eundem; qui antea fuerat, Mercurium
reddunt.

Semimetalla

Hæc conveniunt cum prioribus, nisi quod malleabilitate longe minore, vel plane nulla, gaudeant. Subit autem vegueritia

Zincum: corpus est ex cæruleo album; cum quadam tenacitate fragili; huic malleo quo: cammodo figurabile; longe minus tamen metallis; in igne leviori fluit, ore fumat, vique camini flamma lucis simorum albomaque fleorum ve speciat; valdiore igne ardet flamma viridi elegantissima, sulphuris copiosi præventiam manifeste notans.

Bismuthum constat, ut franguntur, ex tessulis, hæque iterum ex lamellis ubi mutuo approximatis; priori magis fragile; cæterum ex tema facie parum differens; nisi quod non cæruleseat, sed potius luteum fulvo splendore conspicuum sit.

Regulus antimonii est fragillissimus; a sulphure ite depuratus albo nitore priora

superat; majore igne ad vim liquefactionem
reget: unde facile a prioribus duobus distinguitur.

Arsenicum (o-o) vi sunifumeum est, quod
colore albo; vi igne liquescit; tunegue toto vno
corpore vi peril denvisimi fumi, albi, alliacei
odore infesti, avolat; frigefactum vero in volidum,
semidiaphanum, ponderosum, album, corpus coalescit;
non inflammabile est; aere expositum cuticulam
quasi lacteam induit; reducitur in Regulum
antimonii quam simillimum, qui ardet.

A quibusdam Arsenicum refertur ad
sulphura; sed admodum improprie.

Elective Attractions

1 Acids

1 Phlogiston
2 Fixed alkali
3 Lunik lime
4 Magnesia
5 Metallic Substances
6 Volatile alkali
7 Earth of Alum

2 Vitriolic Acid

1 N. 1, 2, 3 & 4 as table
2 Zinc
3 Iron
4 Copper
5 Silver
6 Tin
7 Lead
8 Mercury
9 volatile alkali
10 H

3 Nitrous Acid

1 N°: 1, 2, 3 & 4, a table

2 Zinc

3 Iron

4 Copper

5 Lead

6 Mercury

7 Silver

4 Muriatic Acid

1 N°. 1, 2, 3 & 4 from table 1

2

3 Tin

4 regulus of Antimony

5 Copper

6 Silver

7 Mercury

5 Vegetable Acid

1 N° 1, 2, 3 & 4 from table 1

2 Zinc

3 Copper

4 Lead

6 Aqua regia

1 No 1, 2, 3 & 5 from Stelle i

2

3 Tin

4 Gold

7 Fixed Air

1 metallic Substances

2 Quicklime

3 Fixed Alkali

4 Magnesia

5 volatile alkali

8 Fixed Alkali

1 nitrous
2 nitrous
3 muriatic } Acids
4 vegetable

5 volatile nitrous Acid & vegetable Salt

6 Oil of Vitriol

9 volatile Alkali

1 nitrous acid
2 nitrous do
3 muriatic do
4 vegetable do
5 volatile nitrous Acid & vegetable Salt
6 Oil of Vitriol

10 Absorbent Earths

1 vitriolic Acid
2 nitrous acid
3 muriatic Acid
4 vegetable acid

11 Alkalines

1 Acids
2 Fixed Air

12 water

1 Fixed Air
2 Alcohol
3 neutral Salts

13 water

1 Alcohol
2 mild alkali

14 Alcohol

1 water
2 Oil

15 Metallic Substances

1 muriatic acid
2 vitriolic d.
3 nitrous d.
4 vegetable d.

16 Lead

1 vitriolic acid
2 muriatic acid
3 nitrous acid
4 vegt. acid
5 Oil

17 Regulus of Antimony

1 nitrous. Oxid
2 muriatic acid

18 Gold

1 Ether, essential oils, alcohol
2 Aqua regia

19 Silver

1 mercury
2 ammoniacal salt

20 Silver

1 Lead
2 Copper

21 Mercury

1 Gold
2 Silver
3 Lead
4 Copper
5 Zinc
6 regulus of Antimony

22 Mercury

1 Lead
2 Bismuth

23 Iron

1 Bismuth
2 Regulus of Antimony
3 Copper, Silver

24 Regulus of Antimony

1 Iron
2 Copper
3 Lead, Silver

25 Arsenic

1 Iron
2 Copper
3 Tin
4 Lead
5 Silver
6 Gold

26 Sulphur

1 Fixt alcali. quicklime

2 Iron

3 Copper

4 Tin

5 Lead

6 Silver

7 Regulus of Antimony

8 Mercury

27 Sulphur

1 mercury

2 Arsenic

28 Sulphur

1 mercury

2 volatile alcali

4

[No

Exchange

AT

and *ble*

or Order

Sterling,

[No

Exchange

AT

and *ble*

or Order

Sterling,

MISCELLA